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**THESIS**

**FACTORS AFFECTING THE PERFORMANCE OF  
HISPANIC AND NON-HISPANIC MARINE CORPS  
ENLISTEES**

by

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March 2015

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<p>In its 2011 Final Report, the Military Leadership Diversity Council directed the Armed Forces to develop a demographically diverse leadership. Using multivariate probit and linear regression analysis, and a dataset of 204,000 non-prior service active duty enlisted accessions who entered service between 2003 and 2009, I examine the factors that explain differences in Hispanics' and non-Hispanics' performance outcomes such as first-term attrition, reenlistment and promotion, which ultimately affect senior enlisted leadership demographics. The findings show that Hispanics are more likely to complete their initial term of obligated service than non-Hispanics; however, the "Hispanics" effect disappears or becomes negative later in the career. In this thesis, I also propose and test a performance metric, called "Success Score," derived from commander evaluations, physical fitness tests and rifle marksmanship scores. The findings of the statistical analysis suggest that the "Success Score" measure is the most significant factor in explaining differences in attrition, reenlistment and promotion among Hispanics and non-Hispanics. They also show that mathematical aptitude, as measured by the AR and MK ASVAB subtests, is as important as AFQT in predicting an enlistee's "Success Score." I recommend that the Marine Corps establish a trial group using AR, MK and AFQT scores to assess cognitive ability, along with more stringent waiver and body composition requirements to improve the quality of the enlisted applicant pool.</p>			
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**FACTORS AFFECTING THE PERFORMANCE OF HISPANIC AND NON-HISPANIC MARINE CORPS ENLISTEES**

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Submitted in partial fulfillment of the  
requirements for the degree of

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## **ABSTRACT**

In its 2011 Final Report, the Military Leadership Diversity Council directed the Armed Forces to develop a demographically diverse leadership. Using multivariate probit and linear regression analysis, and a dataset of 204,000 non-prior service active duty enlisted accessions who entered service between 2003 and 2009, I examine the factors that explain differences in Hispanics' and non-Hispanics' performance outcomes such as first-term attrition, reenlistment and promotion, which ultimately affect senior enlisted leadership demographics. The findings show that Hispanics are more likely to complete their initial term of obligated service than non-Hispanics; however, the "Hispanics" effect disappears or becomes negative later in the career. In this thesis, I also propose and test a performance metric, called "Success Score," derived from commander evaluations, physical fitness tests and rifle marksmanship scores. The findings of the statistical analysis suggest that the "Success Score" measure is the most significant factor in explaining differences in attrition, reenlistment and promotion among Hispanics and non-Hispanics. They also show that mathematical aptitude, as measured by the AR and MK ASVAB subtests, is as important as AFQT in predicting an enlistee's "Success Score." I recommend that the Marine Corps establish a trial group using AR, MK and AFQT scores to assess cognitive ability, along with more stringent waiver and body composition requirements to improve the quality of the enlisted applicant pool.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

AFADBD	Armed Forces Active Duty Base Date
AFQT	Armed Forces Qualification Test
AR	ASVAB Arithmetic Reasoning subtest
ASVAB	Armed Services Vocational Aptitude Battery
BMI	Body Mass Index
CDC	Center for Disease Control and Prevention
CFT	Combat Fitness Test
CMP	Combat Marksmanship Program
Con	Duty Conduct Marking
CY	Calendar Year
DEP	Delayed Entry Program
DMDC	Defense Manpower Data Center
DOD	Department of Defense
EAS	End of Active Service
FY	Fiscal Year
GED	General Equivalency Diploma
GMP	General Military Proficiency
GT	ASVAB General Technical composite score
GWOT	Global War on Terrorism
HQMC	Headquarters Marine Corps
HSDG	High School Diploma Graduates
IST	Initial Strength Test
JAMRS	Joint Advertising, Market Research and Studies
JROTC	Junior Reserve Officer Training Corps
MCMAP	Marine Corps Martial Arts Program
MCRC	Marine Corps Recruiting Command
MCRD	Marine Corps Recruit Depot
MCRISS	Marine Corps Recruiting Information Support System
MCTFS	Marine Corps Total Force System
MK	ASVAB Math Knowledge subtest

MLDC	Military Leadership Diversity Council
MM	ASVAB Mechanical Maintenance composite score
MOS	Military Occupational Specialty
NCO	Non-Commissioned Officer
NHSDG	Non-High School Diploma Graduates
OccFld	Occupational Field
OMB	Office of Management and Budget
OLS	Ordinary Least Squares
PC	ASVAB Paragraph Comprehension subtest
PFT	Physical Fitness Test
PMOS	Primary Military Occupational Specialty
Pro	Duty Proficiency Marking
SDA	Special Duty Assignment
SRB	Selective Reenlistment Bonus
TFDW	Total Force Data Warehouse
TFRS	Total Force Retention System
TFSMS	Total Force Structure Management System
TIG	Time in Grade
TIS	Time in Service
USD (P&R)	Under Secretary of Defense for Personnel and Readiness
VE	ASVAB Verbal composite score
WK	ASVAB Work Knowledge subtest

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## **I. INTRODUCTION**

### **A. BACKGROUND**

The Hispanic population accounted for more than half of the United States' population growth between 2000 and 2010. During that decade, the number of people reporting Hispanic ethnicity grew by 43% compared to five % growth for people reporting non-Hispanic ethnicity (Humes, Jones, & Ramirez, 2011). As a result, Hispanic representation in the U.S. population grew from 12.5% in 2000 to 16.3% in 2010 (Humes et al., 2011). During the same period, Hispanic representation was nearly stagnant in the military, growing only one half of one percent (Under Secretary of Defense (Personnel & Readiness) (USD (P&R)), 2002; USD (P&R), 2012). The growth trend of the Hispanic population is expected to continue (Ortman & Guarneri, 2009). The U.S. Census Bureau forecasts that, by 2035, Hispanics could compose 18.5% to 25.7% of the U.S. population, depending on immigration patterns (Ortman & Guarneri, 2009). Divergence between Hispanic population representation and military representation could indicate a trend toward a less diverse and inclusive military.

The Military Leadership Diversity Commission (MLDC) gives two cases for aspiring toward a more representative military (Military Leadership Diversity Commission (MLDC), 2010). The civil-military case states that a diverse military whose composition reflects that of the nation it is tasked to defend is better able to serve its citizens than one that is more homogenous. The business case states that more diversity in the workplace improves performance, effectiveness and innovation (MLDC, 2010). If the Marine Corps does not make an improved effort to attract and retain Hispanics, its long-term military performance may suffer.

### **B. PURPOSE**

With the demographics of the United States changing, the military services are making efforts to attract and retain a diverse pool of talent. The purpose of this study is to identify how Marine Corps enlisted personnel with different ethnic or racial backgrounds compare in job performance outcomes, such as first term attrition, reenlistment,

promotion and performance evaluations. The findings can highlight the factors that explain some of the similarities or differences in job performance among ethnic/racial demographic groups, and can provide the Marine Corps with decision support for creating interventions to enhance job performance, retention and promotion by a diverse body of enlisted personnel.

## **C. RESEARCH QUESTIONS**

### **1. Primary Question**

What background and pre-accession factors are important in explaining any differences in attrition, reenlistment, promotion rates and job performance across demographic groups, especially between Hispanic enlistees and non-Hispanic enlistees?

### **2. Secondary Questions**

1. Does Hispanic ethnicity affect attrition, promotion and reenlistment of enlistees independent of all of the pre-accession attributes and experiences of enlistees?
2. Does citizenship status affect attrition, promotion and reenlistment of enlistees and is there a differential effect of Hispanics versus other race or ethnic groups?
3. Does the pre-accession quality of education as measured by educational credentials differ for Hispanics vs non-Hispanic enlistees?
4. Do pre-accession ASVAB scores differ for Hispanic vs non-Hispanic enlistees?
5. Does the receipt of an MOS enlistment, shipping or selective reenlistment bonus differ for Hispanics vs non-Hispanics and, if so, how does this affect career success for Hispanics vs non-Hispanics?
6. Does accession with an advanced pay grade differ by demographic group and, if so, what is the effect on promotion and reenlistment for applicants who access at pay grades higher than E1?
7. Does the probability of enlisting with civil and/or dependent waivers differ for Hispanics vs non-Hispanics and, if so, do these differences affect subsequent career performance outcomes?
8. Does body composition differ for Hispanic and non-Hispanic enlistees and, if so, what is the effect on career outcomes?
9. Does the amount of time deployed during the first term of service differ for Hispanic vs non-Hispanic enlistees and, if so, how do they affect career success for each group?
10. Does job performance, as measured by proficiency and conduct ratings, physical fitness and marksmanship scores differ by demographic group?

11. Does the distribution of enlisted personnel into combat arms occupation fields (03xx, 08xx, and 18xx) and non-combat arms occupation fields differ by demographic group?

#### **D. SCOPE AND LIMITATIONS**

This thesis focuses on Marine Corps enlistees with no prior service who entered service between FY 2003 and FY 2009. The research uses multivariate estimating models to analyze the effects of demographics and pre-accession factors on performance and experiencing key career outcomes. It uses panel data from the Total Force Data Warehouse (TFDW) system, which merges data from multiple databases including the Marine Corps Recruiting Information Support System (MCRISS), Total Force Retention System (TFRS) and Total Force Structure Management System (TFSMS). Longitudinal files track enlisted personnel career progress from accession through the eight-year E4 High Year Tenure mark.

#### **E. ORGANIZATION OF THE STUDY**

This thesis is organized into six chapters. Chapter I identifies the purpose of the study and its primary and secondary research questions. Chapter II details trends in the relationship between Hispanics and the military and specifies the Marine Corps' accession, evaluation and promotion process. Chapter III reviews recent and relevant literature relating to the analysis of minority performance in the military. Chapter IV explains the process used to clean and aggregate the data. It also describes the variables used in the study, summarizes the key variables. Chapter V identifies the theoretical and empirical models used in the research and describes the results of the multivariate data analysis. Chapter VI summarizes the results and conclusions of the research and makes recommendations based on those results.

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## **II. BACKGROUND**

This chapter discusses factors relevant to the accession, promotion and reenlistment of Hispanics in the Marine Corps. It will begin by identifying how the U.S. government defines Hispanic ethnicity. It will then discuss trends in Hispanic representation in the Marine Corps relative to the greater DOD and the U.S. population at large, trends in propensities to enlist and potential barriers to enlistment of Hispanics. Finally, it will discuss the process for accession and promotion in the Marine Corps.

### **A. HISPANIC DEFINED**

On May 12, 1977, the Office of Management and Budget (OMB) defined the term Hispanic as “a person of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race.” OMB recommended that government agencies obtain distinct race and ethnicity data using the following categories (Office of Management and Budget, 1977):

Race:

- American Indian or Alaskan Native
- Asian or Pacific Islander
- Black
- White

Ethnicity:

- Hispanic origin
- Not of Hispanic origin

This format was adopted by the U.S. Census Bureau for the 1980 and 1990 decennial censuses (Federal Register, 1995). From 1977 through 2002, the Department of Defense (DOD) used this format to collect self-reported ethnicity data (Office of the Under Secretary of Defense (Personnel and Readiness) [USD (P&R)] 2009). In 1997, due to increasing criticism that the race and ethnicity labels were inaccurate and did not represent the increasing diversity of the American people, OMB required the federal government to change the categories used for respondents to self-report race and ethnicity data (Federal Register, 1995). This revision required that race and ethnicity data be

collected separately and the term “Hispanic” be replaced by “Hispanic or Latino” (Federal Register, 1997). Although this changed how data was collected and stored, the U.S. Census Bureau still uses the 1977 OMB definition of Hispanic or Latino (Humes et al., 2011).

## B. REPRESENTATION

As indicated in Table 1, Panel 1, in 2002, Hispanics were overrepresented among all Marine Corps enlisted personnel. In 2002, Hispanics comprised 13.9% of the U.S. population, but made up 14.2% of Marine Corps enlistees ((USD (P&R), 2004). Over the next 11 years, Hispanic representation in the U.S. grew to 19.6% (a 41% growth rate), but Hispanic representation in the Marine Corps grew to only 15.5% (an eight % growth rate) (USD (P&R), 2013). The disparity is even greater among Hispanic males, who compose 15.1% of the Marine Corps versus 21.5% of the civilian labor force 18 to 44 years of age (USD (P&R), 2013). As shown in Figure 1, the transformation from a slight overrepresentation to a six- percentage point (30%) underrepresentation occurred during a period when Hispanic enlistments increased relative to non-Hispanic enlistments, nearly closing the gap in accession representation. Although overall Hispanic representation among Marine Corps enlistees and among new enlisted accessions is better than the DOD as a whole, the continued underrepresentation in the Marine Corps compared to the civilian population presents a challenge for recruiters and policy makers.

Table 1. Enlisted Accessions and Representation in the Marine Corps versus Civilian Population (after USD(P&R), 2005; USD(P&R), 2013)

Panel 1: Accessions			
	2003	2012	Growth Rate
Hispanic Civilian Population (Ages 18-24)	17.3%	20.7%	19.4%
Marine Corps Accessions	14.6%	20.5%	40.0%
Panel 2: Enlisted Representation			
	2002	2012	Growth Rate
Hispanic Civilian Population (Ages 18-44)	13.9%	19.6%	41.1%
Marine Corps Representation	14.2%	15.5%	8.8%

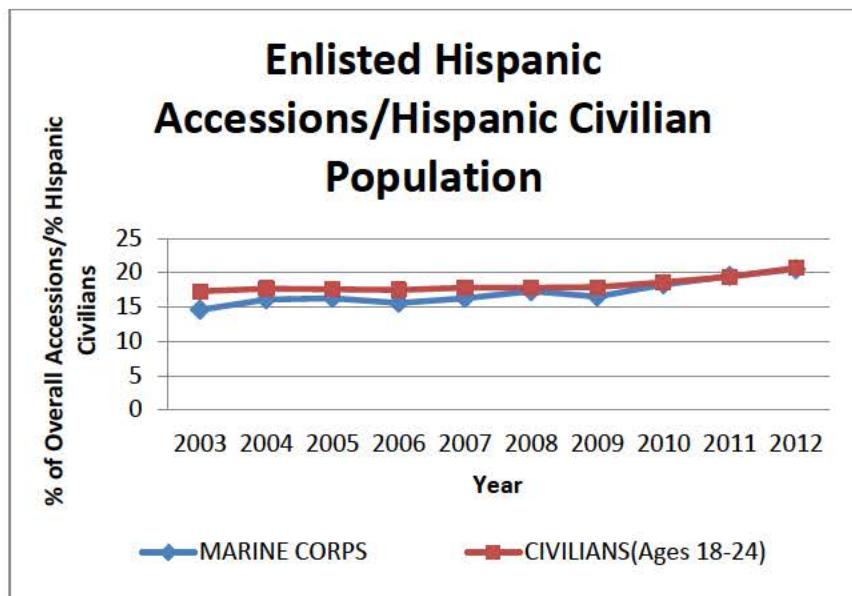


Figure 1. Hispanic Accession Representation in the Marine Corps  
(after USD(P&R), 2014)

### C. PROPENSITY TO ENLIST

The Department of Defense's Joint Advertising, Market Research and Studies (JAMRS) group calculates youth military propensity to enlist from surveys based on whether youths respond that they will definitely or probably enlist in the military in the next few years (2012). Although youth propensity surveys do not accurately predict actual individual behavior, they can be used to predict the likely behavior of population subgroups (Armor & Gilroy, 2009). Someone who self-reports the highest likelihood of enlisting ("definitely" enlisting) is 15 times more likely to actually enlist than someone who self-reports the lowest likelihood ("definitely not") (JAMRS, 2012). As Figure 2 shows, in 2002, Hispanics had a higher positive propensity to enlist (24%) than Blacks (15%) and Whites (10%). In 2007, propensities to enlist converged as the number of youths who said they would "definitely" or "probably" enlist decreased for all races and ethnicities, possibly due to perceived conditions in Iraq and Afghanistan and an expanding economy. From 2008 to 2014, as conditions improved in Iraq and the U.S. entered a severe economic recession, propensities for Blacks and Hispanics increased, while those for Whites and Asians remained stagnant (Armor & Gilroy, 2009; JAMRS, 2014).

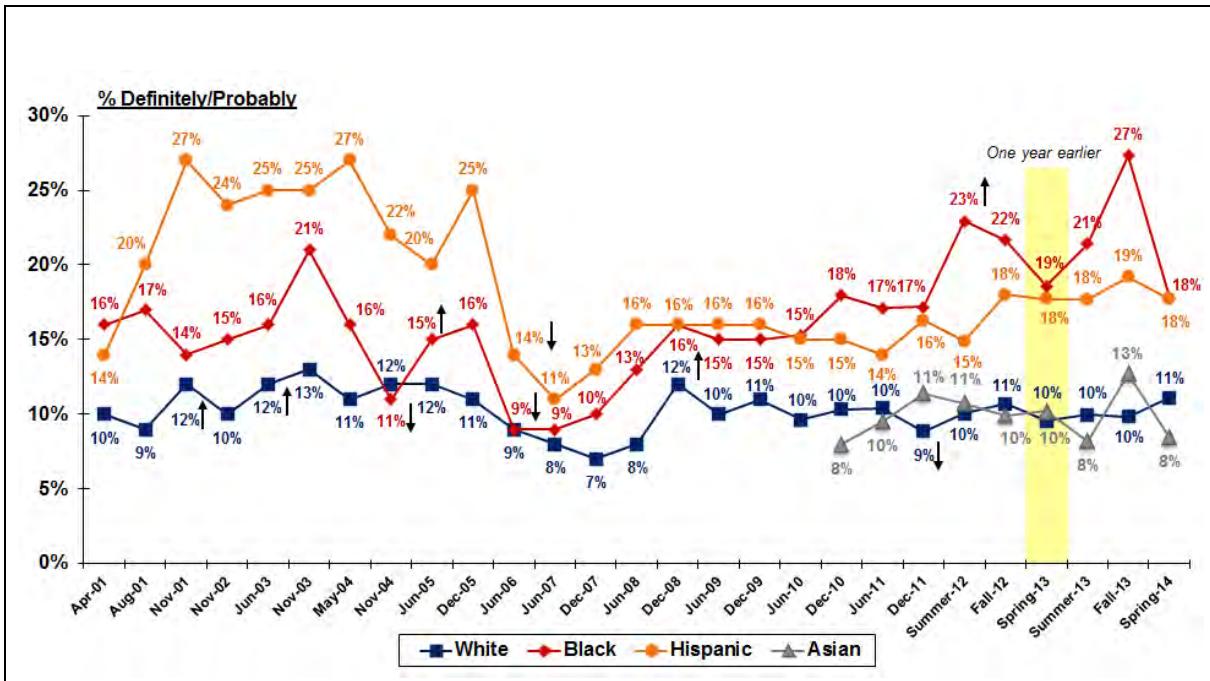


Figure 2. Youth Propensity to Enlist by Race & Ethnicity  
(from JAMRS, 2014)

#### D. BARRIERS TO ENLISTMENT

According to the Military Leadership Diversity Commission (MLDC), there are several requirements for entry into the Marine Corps that tend to disqualify Hispanics at higher rates than non-Hispanics. These factors include high school degree requirements, Armed Forces Qualification Test (AFQT) minimum scores, and height and weight standards. (Military Leadership Diversity Commission (MLDC), 2011a).

##### 1. High School Diploma

The DOD divides educational attainment status into three tiers using the traditional high school diploma as the standard of measurement. A Tier I candidate is anyone who completes a 12-year, daytime, structured program of classroom instruction and receives a locally issued diploma (Headquarters Marine Corps (HQMC), 2004). A Tier II candidate is anyone who has received an alternative credential such as a General Equivalency Diploma (GED), certificate of attendance or occupational program certificate (HQMC, 2004). A Tier III candidate is anyone who has failed to receive a

traditional diploma or alternative credential (HQMC, 2004). Neither the DOD nor the Marine Corps require candidates to be high school graduates (HQMC, 2004). However, Tier I candidates are highly preferred over Tier II and III candidates because of their significantly lower attrition rate (Buddin, 2005). The DOD requires at least 90% of accessions to be Tier I candidates and the remaining 10% to be primarily Tier II candidates (Department of Defense, 2013). The Marine Corps only requires that a Tier II or III candidate complete the 10th grade at a traditional high school; however, Tier II and III candidates must have higher AFQT scores than a Tier I candidate to be eligible for enlistment (HQMC, 2004). In 2008, the high school graduation rate for adults age 25–29 was only 68% for Hispanics compared to 88% for Blacks and 94% for whites (MLDC, 2011b). The annual *DOD Population Representation Report* combines Tier I and Tier II candidates for the 18- to 24-year-old civilian population. In 2012, 74.5% of Hispanic civilians in that age group were Tier I versus 80.6% of Blacks and 83.4% of Whites (USD (P&R), 2014).

## **2. AFQT**

The AFQT is a composite of four subtests of the Armed Services Vocational Aptitude Battery (ASVAB), an aptitude test given to each prospective candidate for military service. The Marine Corps uses the AFQT to screen enlistees for general mental aptitude (HQMC, 2004). The DOD has five Mental Group Categories derived from AFQT scores (Table 2). The Marine Corps requires Tier I candidates to achieve at least a Category 4 score (HQMC, 2004). Tier II candidates must achieve a category 3B score or higher. Tier III candidates must achieve a category 3A score or higher (HQMC, 2004). The DOD puts further restrictions on AFQT scores, requiring services to enlist no more than four % Category 4 candidates and at least 60% Category 3A or higher candidates (Department of Defense, 2013). In practice, however, receiving a Category 3B score or higher is the standard for enlistment. In 2012, only .2% of all DOD enlistments and 1% of Marine Corps enlistments were Category 4 (USD (P&R), 2013). If Category 3B is the standard, Hispanics are at a disadvantage relative to Whites. Asch et al. determined that 53% of Hispanics would achieve a category 3B score or higher versus 49% of Blacks and 80% of Whites (Asch, Buck, Klerman, Kleykamp, & Loughran 2009). Asch et al. also

assert that the AFQT requirement represents a more significant obstacle to enlistment for Hispanics than the educational attainment requirement (2009).

Table 2. DOD Mental Group Categories (after HQMC, 2004)

Category	AFQT Score
Category 1	93 - 99
Category 2	65 - 92
Category 3A	50 - 64
Category 3B	31 - 49
Category 4	21 - 30

### 3. Weight

The Marine Corps has the least stringent weight standards of the four services when determining qualification for enlistment into the Delayed Entry Program (DEP) (Hattiangadi, Lee & Quester, 2004). To ship to the Recruit Depot, however, requires recruits to fall within 105% of the service retention weight standards and to pass an Initial Strength Test (HQMC, 2004). Retention, shipping and DEP weight standards are based on height and equate to an approximate Body Mass Index (BMI) of 27.5, 29 and 31, respectively (HQMC, 2004). According the CDC, an adult with a BMI greater than or equal to 25 and less than 30 is considered “Overweight.” An adult with a BMI greater than 30 is considered “Obese” (Center for Disease Control and Prevention (CDC), 2014). Male Marine Corps recruits with BMI near 31 attrite from basic training at more than twice the mean rate of attrition (25% versus 10.4%) and attrite from technical training at more than 5 times the mean rate of attrition (13% versus 2.3%) (Buddin, 1989). BMI is calculated using the CDC standard measurement formula (Equation [1]) (CDC, 2014):

$$[1] \quad BMI = \frac{Weight(pounds)}{Height(inches)^2} * 703$$

On average, among youths ages 17–21, Hispanic males weigh 9.7 pounds more than white males and Hispanic females weigh 7.6 pounds more than white females (Asch et al., 2009).

## **E. PROMOTIONS**

The three objectives of the Marine Corps Enlisted Promotion Process are to maintain the actual strength in each grade and military occupational specialty (MOS) or occupational field (OccFId) at the maximum readiness for commitment to combat, to ensure that all eligible Marines receive full and equitable opportunity to compete for promotion and to ensure that only the best and fully qualified Marines are promoted (HQMC, 2006).

### **1. Promotion Process**

Most recruits enter the Marine Corps as a Private (E1). Recruits who have completed 12 semester hours or 18 quarter hours of college, completed a two-year Junior Reserve Officer Training Corps (JROTC) program, served as Eagle Scouts in the Boy Scouts of America or have met any other criteria specified in Table 4-2 of MCO P1100.72C (Figure 3), are eligible to enter service as a Private First Class (E2) (HQMC, 2000). Otherwise, a Private with six months time in grade (TIG) with satisfactory service as deemed by the commander will automatically be selected for promotion to PFC (HQMC, 2006). A PFC with eight months TIG, nine months time in service (TIS) and otherwise qualified for promotion as deemed by his commander, will automatically be selected for promotion to Lance Corporal (E3) (HQMC, 2006).

**TABLE 4-2**  
**APPOINTMENT TO A GRADE OTHER THAN PRIVATE UPON ENLISTMENT.**

R	A	B
U	If an applicant (notes 1 through 4):	Then grade upon enlistment will be:
L		
E		
1	has prior service (other service) with six or more months of active duty (180 consecutive days) to include continuous active duty training	Private First Class (notes 5 & 6)
2	is a high school graduate and has evidence of successful completion of a two year Reserve Officer Training Course (ROTC)	
3	is a high school graduate and has evidence of successful completion of two or more years or equivalent, (i.e. 4 X 4 Block Schedule one semester = one year) of a Junior Reserve Officer Training Course (JROTC) verified by JROTC Unit, or a graduate of a four year High School Military Academy (must have attended for four years)	(note 6)
4	enlists in the DEP or SMCR awaiting IADT and refers two (2) applicants who subsequently enlist	(note 7)
5	has completed the Pre-commissioning or Commissioning Crs, formerly called junior and senior course of the Platoon Leaders Class (PLC) or the Officer Candidate Course (OCC)	
6	a. Has evidence of completing 12 semester hours/18 quarter hours of college level courses from an institution listed in the degree granting section of the AIPE, and attained a minimum grade point average of C+ (2.3 or better on 4.0 scale). College hours do not have to be completed in the same semester or quarter, but total college hours must be used to calculate the GPA. (See Notes 1 & 2 below)	
	<b>Note 1:</b> Non Tier I applicants must have completed the 10 <sup>th</sup> grade in a traditional, religious, home school, or continuation/alternative high school, to be promoted under this rule.	
	<b>Note 2:</b> Applicants who are educationally coded XX8 are not eligible to apply the same college semester hrs/qtr hours for promotion, which qualified their educational tier status. Additional hours, beyond the 15 semester and/or 22 quarter hours classifying as Tier I, may be used if in accordance with rule 6a. (Minimum 27 semester/40 qtr hrs.)	
	b. Applicants whose verified education code is 14D or 16K	
7	Enlists under the provisions of the Enlistment Incentive Program: College Enlistment Program (CEP) or Musician Enlistment Option Program (MEOP) contained in MCO 1130.53	(note 11)
8	Marine Cadets of America	(note 11)
9	is an Eagle Scout in the Boy Scouts of America or a Girl Scout Gold Award in the Girl Scouts of America	(note 8)
10	attained grade E-3 or completed at least 24-months in the Naval Sea Cadet Corps	(note 8)
11	enlists for duty with the U.S. Marine Band (Presidents Own, Marine Barracks 8 <sup>th</sup> & I, Washington DC) only	Staff Sergeant (note 9)
12	Young Marines who have achieved the rank of E-5.	(note 10)

Figure 3. Criteria for Accession at Advanced Pay Grade (from HQMC, 2000)

A Marine promoted beyond the rank of Lance Corporal enters the corps of Non-Commissioned Officers (NCOs). The Marine Corps depends on the proper development of its NCOs to accomplish its congressionally mandated missions (HQMC, 2006). Consequently, MCO P1400.32D prohibits the promotion of any Marine to Corporal (E4) or Sergeant (E5) "who has not positively demonstrated the potential, motivation, and maturity to satisfactorily discharge the duties of a small unit leader" (HQMC, 2006). Monthly authorized promotions for each primary MOS are based on vacancy. The Commandant of the Marine Corps (CMC) controls the number of promotions to Corporal

and Sergeant through the use of composite score (HQMC, 2006). A composite score is a numerical representation of certain performance and service data. It is calculated quarterly (Appendix C) and used to compare Marines of the same rank within the same MOS or Occupational Field (OccFld) for promotion (HQMC, 2006). The Cutting Score is the lowest composite score of all Marines within a primary MOS selected for promotion that month (HQMC, 2006). Although HQMC determines the Lance Corporals and Corporals selected for promotion, it is the responsibility of the unit commander (Battalion or higher) to award promotion to the selected Marines who possess the capabilities necessary to discharge the duties of a small unit leader (HQMC, 2006).

## **2. General Military Proficiency**

The General Military Proficiency (GMP) score is a component of the Composite Score. It is an average of the ratings derived from the current rifle marksmanship score, the physical fitness test (PFT) and the combat fitness test (CFT). All Marines are required to complete a PFT annually between 1 January and 30 June, a CFT between 1 July and 31 December and rifle qualification annually during the current fiscal year (HQMC, 2006). Prior to 2009, the CFT requirement did not exist and all Marines were instead required to complete a physical fitness test (PFT) semiannually during each half of the calendar year. During this period, the General Military Proficiency score was derived by averaging the ratings derived from rifle marksmanship score and the most current PFT (HQMC, 2006).

In 2007, the Marine Corps instituted the Combat Marksmanship Program (CMP). CMP expanded the annual requirements for qualification adding a Basic Combat Rifle Marksmanship course of fire to the traditional Fundamental Rifle Marksmanship (Known Distance) course of fire (HQMC, 2014). The additional requirements increased the total possible points from 250 to 350 (HQMC, 2014). The Rifle Conversion Chart used to calculate the GMP score changed as well to reflect the greater number of possible points. Prior to Fiscal Year 2004, the Marine Corps evaluated recruits' initial marksmanship training with the 250 point scale used to evaluate the current Known Distance course of fire and evaluated follow on annual training with a 65 point scale.

### **3. Proficiency and Conduct Markings**

Commanders at or above the battalion level evaluate the performance of Corporals and below through the use of Duty Proficiency (Pro) and Conduct (Con) markings (HQMC, 2000). These markings are assigned at least semiannually, but are also assigned if a Marine changes duties, completes training or meets any of the other occasion requirements delineated in Table 4-3 of MCO P1070.12K (HQMC, 2000). Proficiency markings are intended to reflect how well a Marine performed his primary duty during the marking period and how well he demonstrated attributes such as mission accomplishment, leadership, intellect and wisdom, individual character, physical fitness and personal appearance (HQMC, 2000). Table 3 provides the guidelines for assigning proficiency markings.

Conduct markings are intended to reflect how well a Marine followed rules and regulations, conformed to customs and courtesies and positively contributed to his unit and the Corps (HQMC, 2000). Factors evaluated include bearing, reliability, obedience, adaptability, moral and physical fitness (HQMC, 2000). Table 4 provides the guidelines for assigning conduct markings. Although the Battalion Commander assigns Pro and Con marks, he is expected to consult with the officer and Staff NCO who regularly supervise and interact with the Marine to determine fair and accurate markings (HQMC, 2000).

Table 3. Duty Proficiency Guidelines (from Headquarters Marine Corps, 2000)

MARK	CORRESPONDING ADJECTIVE RATING	STANDARDS OF PROFICIENCY
0.0 to 1.9	Unacceptable	Does unacceptable work in most duties, generally undependable; needs considerable assistance and close supervision on even the simplest assignment. Demonstrates positive effect on others by example and persuasion.
2.0 to 2.9	Unsatisfactory	Does acceptable work in some of the duties but cannot be depended upon. Needs assistance and close supervision on all but the simplest assignments.
3.0 to 3.9	Below Average	Handles routine matters acceptably but needs close supervision when performing duties not of a routine nature.
4.0 to 4.4	Average	Can be depended upon to discharge regular duties thoroughly and competently but usually needs assistance in dealing with problems not of a routine nature.
4.5 to 4.8	Excellent	Does excellent work in all regular duties, but needs assistance in dealing with extremely difficult or unusual assignments.
4.9 to 5.0	Outstanding	Does superior work in all duties. Even extremely difficult or unusual assignments can be given with full confidence that they will be handled in a thoroughly competent manner.

Table 4. Duty Conduct Guidelines (from Headquarters Marine Corps, 2000)

MARK	CORRESPONDING ADJECTIVE RATING	STANDARDS OF CONDUCT
0.0 to 1.9	Unacceptable	Habitual offender. Conviction by general, special or more than one summary court-martial. Give a mark of "0" upon declaration of desertion. Ordered to confinement pursuant to sentence of court-martial. Two or more punitive reductions in grade.
2.0 to 2.9	Unsatisfactory	No special court-martial. Not more than one summary court-martial. Not more than two non-judicial punishments. Punitive reduction in grade.
3.0 to 3.9	Below Average	No court-martial. Not more than one non-judicial punishment. No favorable impression of the qualities listed in paragraph 4007.6a. Failure to make satisfactory progress while assigned to the weight control or military appearance program. Conduct such as not to impair appreciably one's usefulness or the efficiency of the command, but conduct not sufficient to merit an honorable discharge.
4.0 to 4.4	Average	No offenses. No unfavorable impressions as to attitude, interests, cooperation, obedience, after-effects of intemperance, courtesy and consideration, and observance of regulations.
4.5 to 4.8	Excellent	No offenses. Positive favorable impressions of the qualities listed in paragraph 4007.6a. Demonstrates reliability, good influence, sobriety, obedience, and industry.
4.9 to 5.0	Outstanding	No offenses. Exhibits to an outstanding degree the qualities listed in paragraph 4007.6a. Observes spirit as well as letter of orders and regulations. Demonstrates positive effect on others by example and persuasion.

## **F. ASSIGNMENT**

For Marine Officers, career field assignment and key billet assignment heavily influence promotion to the highest levels of leadership (MLDC, 2011a). Across the DOD, nearly 70% of General Officers come from Tactical/Operational career fields whose mission is closely tied to their services' primary mission (MLDC, 2011a). Furthermore, officer career progression aligns with the execution of key billets, such as platoon and company command. However, among enlisted Marines, there is little research identifying the relationship between career field assignment, key billet assignment and career progression. The conventional wisdom dictates that because promotions are determined by vacancy within each MOS and because enlisted personnel rarely compete for promotion across MOS, there are no key assignments for the junior enlisted pay grades (E1-E6) (MLDC, 2011a).

Any Marine who is screened for and selected for a Special Duty Assignment (SDA), however, will be considered "Highly Qualified" for promotion (HQMC, 2006). Lance Corporals and Corporals assigned to SDA will have 100 points added to their composite score (HQMC, 2006). Sergeants and above who are eligible for promotion will be considered as "Highly Qualified" by the selection board (HQMC, 2006). The selection board is directed to assume that any "Highly Qualified" Marine is superior to those eligible Marines without that designation, unless evidence from other assignments exists to counter that claim (HQMC, 2006). Furthermore, Sergeants and Staff Sergeants assigned to SDA are eligible for meritorious promotion to Staff Sergeant (E6) and Gunnery Sergeant (E7), respectively, if they meet eligibility criteria (HQMC, 2006). Finally, because of the SDA's burdensome duties or responsibilities, those Marines assigned to SDA billets are entitled to SDA pay in addition to their other pay and entitlements (HQMC, 2013a). Any Lance Corporal or above with at least four years TIS can be screened for a special duty assignment. Special Duty Assignments are assigned billet MOS 0911 (Drill Instructor), 8152 (Marine Corps Security Forces), 8156 (Marine Security Guard), 8411 (Recruiter) or 8513 (Combat Skills Instructor) (HQMC, 2013a).

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### **III. LITERATURE REVIEW**

#### **A. OVERVIEW**

Many prior studies attempt to quantify the effects of individual, educational and other factors on the military performance of enlisted personnel. These studies typically use milestone attrition, retention or promotion outcomes to assess performance. Although low attrition is desirable, attrition, retention and promotion may not be the most accurate indicators of performance. Attrition measures a lack of persistence and can be indicative of poor performance or a poor match between the recruit and the military. Reenlistment and promotion indicate the absence of poor performance, but do not necessarily measure superior performance. A Marine who is offered and accepts reenlistment is not superior to one who is offered and declines reenlistment, although the former is commonly accepted as a positive outcome with respect to career service, while the latter is considered negative. Nor do positive promotion outcomes necessarily indicate superior performance. Based solely on promotion, there is no difference between someone who promotes to E4, completes her four years of obligated service and chooses to leave voluntarily with an honorable discharge versus someone who promotes to E4 but is forced to separate with a bad conduct discharge before the expiration of his five-year contract because of an infraction of the Uniform Code of Military Justice.

This study is unique in that it attempts to create alternative measures of the performance of enlisted Marines. The new measures are based on proficiency and conduct markings, marksmanship scores, fitness and other individual factors that are used internally by the Marine Corps to evaluate candidates for promotion to Corporal and Sergeant and screen for reenlistment (HQMC, 2006; Crider, 2015). Each of the studies reviewed below is linked to this thesis because they use quantitative methodologies and focus on the effects of demographic and educational background on military outcome measures.

## B. WENGER AND HODARI (2004)

Wenger and Hodari (2004) examine how individual and educational background affect short-term (within the first six months) and longer-term (within 36 months) attrition of enlistees from all four services. Prior research suggests education credential measures factors other than aptitude, such as persistence or social adjustment. Wenger and Hodari's study is unique in that it tries to quantify the effects of non-cognitive attributes of individuals on performance including a measure of "determination" of the recruit. The data for much of this analysis comes from 65,000 surveys given to recruits of all services who accessed between March 1999 and February 2000. The survey queries behaviors, attitudes, demographic, background and education characteristics. The authors merge the survey data with the surveyed recruit's official personnel data from the Defense Manpower Data Center (DMDC) to observe the relationship between individual attributes and educational information and attrition.

### 1. Methodology

Wenger and Hodari use multivariate probit regressions to determine how the selected explanatory variables affect 6- and 36- month attrition. Equation [2] shows the estimating model where TIS=Time in Service,  $\beta_0$ ,  $\beta_1$  and  $\beta_2$  are coefficients to be estimated and  $\mu$  is a random error term. They use a single model to accomplish this, estimating it with data for three samples:

1. the full sample
2. NHSDGs only
3. HSDGs only.

$$[2] \quad \Pr(TIS < 36\text{months} | X) = \beta_0 + \beta_1(\text{IndividualCharacteristics}) + \beta_2(\text{EducationalCharacterisitics}) + \mu$$

Individual characteristics include age, race, ethnicity, gender, AFQT score, months in DEP and non-cognitive factors derived from survey responses such as "determination," smoking patterns and enlistment waivers. Educational background is broken into credentials such as certificate of completion, General Equivalency Diploma (GED), occupational certificate and homeschool completion. Homeschool graduates were further identified by the regulatory requirements governing home schools in their home

state. Some states impose strict regulations for setting up home schools, whereas others have less restrictive regulations (Wenger & Hodari, 2004). Individual characteristics also include behavioral characteristics such as “ever expelled from school” and number of years of school attendance. Because of the well documented differences in attrition outcomes between Tier I and Tier II candidates, the authors identify the estimated effects of the explanatory variables on the entire sample’s probability of attrition but also differentiate estimates of effects separately for only High School Diploma Graduates (HSDG) and for only Non-High School Diploma Graduates (NHSDG). The reference category for all samples is a white, male, non-Hispanic, non-smoker, who is 18 years of age with three months in DEP. The authors use public school graduates for the reference category in the entire sample and HSDG models. They use high school dropouts who have no educational credentials as the reference category in the NHSDG models.

## 2. Results

The results are displayed in Tables 5–7 below. The 36-month attrition rate for the entire sample in Table 5 is 28.3%, but is 41.1% for NHSDGs (Table 6) and 25.5% for HSDGs (Table 7). Gender is statistically and practically significant in all three samples. Being female increases the estimated probability of 36-month attrition by 8.1 ppts (28.6%) for single females and 17.3 ppts (61.1%) for married females in the full sample. The effect of being a single female increases the probability of attrition by 6.1 ppts (14.8%) in the NHSDG sample and by 8.0 ppts (31.4%) in the HSDG sample. The effect of being a married female increases the probability of attrition by 15.1 ppts (36.7%) in the NHSDG sample and 17.4 ppts (68.2%) in the HSDG sample.

Race and ethnicity are also statistically and practically significant. Overall, in the full sample, an African-American’s estimated probability of attriting is 2.6 ppts (9.2%) higher than the estimated probability of attriting for Whites. This effect is larger for NHSDGs (5.7 ppts, 13.9%) and smaller for HSDGs (1.9 ppts, 7.5%). In the full sample, a Hispanic recruit’s estimated probability of attriting is 4.8 ppts (17.0%) lower than for whites, while an Asian-Pacific Islander is 5.2 ppts (18.4%) less likely to attrite. Among NHSDGs, a Hispanic recruit is 4.7 ppts (11.4%) and an Asian-Pacific Islander is 6.0 ppts

(14.6%) less likely to attrite when compared to white recruits. Among HSDGs, Hispanic recruits are 4.5 ppts (17.6%) and Asian-Pacific Islanders are 4.9 ppts (19.2%) less likely to attrite than Whites.

The authors classify a recruit as “not determined” if his survey responses indicated that he thought about dropping out of high school based on one of five reasons for dropping out such as: “boredom” or “failure to get along with teachers or other students.” A recruit who did not think about dropping out or did not select any of the identified reasons if he did think about dropping out, is classified as “determined.” In the entire sample, “determined” recruits are 6.1 ppts (21.6%) less likely to attrite than those who are “not determined.” “Determined” recruits in the NHSDG sample are 4.2 ppts (10.2%) less likely to attrite than those who are “not determined,” while in the HSDG sample they are 6.4 ppts (25.1%) less likely to attrite.

The authors assert that expulsion from high school is an accurate predictor of poor military performance because it occurs for behavioral instead of academic reasons. Recruits in the full sample who reported a history of expulsion are 6.0 ppts (21.2%) more likely to attrite than those who did not report a history of expulsion in the entire sample. Among HSDGs, recruits with a history of expulsion are 6.2 ppts (24.3%) more likely to attrite. Among NHSDGs they are 5.3 ppts (12.9%) more likely to attrite.

The authors classify a recruit as a “light smoker” if he reported using tobacco less than four times per week prior to entering DEP. They classify him as a “heavy smoker” if his reported tobacco use exceeded three times per week. Based on this classification, tobacco use is one of the most statistically and practically significant factors affecting attrition. In the entire sample, light smokers are 4.4 ppts (15.5%) more likely to attrite than non-smokers, while heavy smokers are 13.5 (47.7%) more likely to attrite. Among HSDGs, light smokers are 3.6 ppts (14.1%) and heavy smokers are 12.7 ppts (49.8%) more likely to attrite. Among NHSDGs, light smokers are 7.8 ppts (19.0%) and heavy smokers are 15.1 ppts (36.7%) more likely to attrite.

In the full sample, recruits who spend more than three months in DEP have an estimated 2.8 ppt (9.9%) lower probability of attriting within 36 months, while those who spend one month or less in DEP have an estimated 4.2 ppt (15.2%) higher probability of 36-month attrition. Marine recruits who access with waivers have a 3.8 ppt (13.4%) higher estimated probability of 36-month attrition than those who access without a waiver. Recruits with certificates of completion or attendance have a 3.4 ppt (12.0%) lower estimated probability of attrition when compared to public school graduates in the total sample and an 11.9 ppt (29.0 %) lower probability of attrition when compared to dropouts in the NHSDG sample.

### **3. Evaluation**

One of the strengths of the Wenger and Hodari study is that it attempts to control for non-cognitive factors such as “determination” in explaining why NHSDGs have much higher attrition rates than HSDGs. Not only does it yield empirical data about the attrition effects of non-cognitive factors (e.g., “determination” and pre-accession smoking) and education credential, but it also highlights how the increasingly more common certificate of high school completion and homeschool certificate affect attrition. The study is limited by its use of attrition to measure performance, its small observation period and the author’s decision not to control for service (with the exception of waiver status).

Table 5. Regression Results, Entire Sample (n=56,576)  
 (from Wenger & Hodari, 2004)

Variable	Mean	Coefficient	z-ratio	Marginal
Age 17	0.055	0.2214	4.52	4 .6
Age 19	0.241	0.0442	1.54	0.9
Age 20	0.114	-0.0212	-0.57	-0.4
Age 21-22	0.115	-0.095	-2.48	-1.9
Age 23 or more	0.09	0.0301	0.71	0.6
Married female	0.016	0.7607	9.32	17.3
Single female	0.161	0.3834	12.32	8.1
African-American	0.197	0.1271	3.91	2.6
Hispanic	0.106	-0.2485	-5 .22	-4.8
Asian -Pacific Islander	0.049	-0.2774	-4.9	-5.2
Other race	0.065	0.0053	0.09	0.1
AFQT	58.7	-0.0077	-11.4	-0.2
DEP months missing	0.688	0.0007	0.01	0.01
One month in DEP	0.141	0.2061	3.06	4.3
Two months in DEP	0.042	0.0087	0.1 1	0.2
> 3 months in DEP	0.098	-0.1448	-2.04	-2 .8
Ever expelled	0.047	0.2848	5.82	6
Determined	0.137	-0.2888	8.94	6.1
Light smoker	0.18	0.2142	6.87	4.4
Heavy smoker	0.317	0.6456	24.95	13.5
Army waiver	0.04	0.0245	0.43	0.5
Air Force waiver	0.033	0.0647	0.93	1.3
USMC waiver	0.099	0.1827	2.99	3.8
Navy waiver	0.105	0.2693	6.44	5.6
Private school graduate	0.043	0.0497	0.88	1
GED	0.049	0.5095	10.5	1 1.1
1 sem college, academic	0.024	0.211	3.02	4.4
1 sem college, vocation	0.007	0.4386	3.65	9.6
Adult education	0.024	0.3394	5. 15	7.3
Correspondence school	0.003	-0.1 139	-0.57	-2 .2
Occupational certificate	0.012	0.0118	0.12	0.2
Cert of complete/attend	0.016	-0.1746	- 1 .85	-3.4
Dropout	0.041	0.472	9.1	10.3

Table 6. Regression Results, NHSDGs (n=10,006)  
 (from Wenger & Hodari, 2004)

Variable	Mean	Coefficient	z-ratio	Marginal Effect
Age 17	0.049	0.3256	2.84	8.1
Age 19	0.233	-0.0308	-0.45	-0.8
Age 20	0.138	-0.2189	-2.7	-5.4
Age 21 -22	0.159	-0.3063	-3.9	-7.5
Age 23 or more	0.157	-0.1836	-2.25	-4.5
Married female	0.026	0.6125	3.82	15.1
Single female	0.099	0.2447	2.83	6.1
African -American	0.186	0.229	3.12	5.7
Hispanic	0.117	-0.1916	-1.94	-4.7
Asian -Pacific Islander	0.054	-0.243	-2.09	-6
Other race	0.069	0.1142	0.97	2.9
AFQT	56.3	-0.0072	-4.35	-0.2
DEP months missing	0.549	0.2655	1.92	6.6
One month in DEP	0.251	0.3139	2.42	7.8
Two months in DEP	0.053	0.3332	2.12	8.3
> 3 months in DEP	0.108	0.1218	0.86	3
Ever expelled	0.115	0.2136	2.83	5.3
Determined	0.37	-0.1699	-3.21	-4.2
Light smoker	0.163	0.3128	4.26	7.8
Heavy smoker	0.481	0.6091	10.53	15.1
Army waiver	0.05	0.0457	0.39	1.1
Air Force waiver	0.018	-0.0034	-0.03	-0.2
USMC waiver	0.101	-0.0389	-0.28	-0.9
Navy waiver	0.23	0.2462	3.28	6.1
GED	0.276	0.0005	0.01	0.01
1 sem college, academic	0.136	-0.1476	-1.67	-3.7
1 sem college, vocation	0.04	0.0638	0.48	1.6
Adult education	0.136	0.0517	0.56	1.3
Correspondence school	0.018	-0.3981	-1.88	-9.7
Occupational certificate	0.066	-0.3077	-2.51	-7.6
Cert of complete/attend	0.091	-0.4896	-4.11	-11.9
Twelve years of school	0.4314	-0.3687	-5.01	-9.1

Table 7. Regression Results, HSDGs & Homeschooled Recruits (n=47,071)  
 (from Wenger & Hodari, 2004)

Variable	Mean	Coefficient	z-ratio	Marginal Effect
Age 17	0.058	0.1909	3.55	3.7
Age 19	0.242	0.0471	1.48	0.9
Age 20	0.109	0.0192	0.46	0.4
Age 21-22	0.105	-0.0442	-1.01	-0.8
Age 23 or more	0.076	0.0747	1.49	1.4
Married female	0.014	0.8019	8.52	17.4
Single female	0.174	0.4034	12.13	8
African-American	0.199	0.1015	2.8	1.9
Hispanic	0.104	-0.2584	-4.78	-4.5
Asian -Pacific Islander	0.048	-0.2 861	-4.42	-4.9
Other race	0.064	-0.0307	-0.48	-0.6
AFQT	59.2	-0.0081	-10.96	-0.1
DEP months missing	0.717	-0.1107	-1.49	-2.1
One month in DEP	0.118	0.1386	1.79	2.6
Two months in DEP	0.04	-0.1353	-1.48	-2.4
> 3 months in DEP	0.096	-0.2689	-3.33	-4.7
Ever expelled	0.032	0.31 12	4.81	6.2
Determined	0.088	-0.32 60	-7.98	6.4
Light smoker	0.184	0.1849	5.37	3.5
Heavy smoker	0.283	0.6466	22.42	12.8
Army waiver	0.038	0.0188	0.29	0.4
Air Force waiver	0.036	0.0787	1.08	1.5
USMC waiver	0.099	0.2325	3.43	4.5
Navy waiver	0.078	0.2835	5.57	5.6
Private school graduate	0.052	0.0443	0.79	0.8
Homeschooled, state with no regs	0.0028	1.057	5.49	23.8
Homeschooled, state with regs	0.0078	0.3359	2.64	6.7

### C. ARIAS AND DAL (2006)

Arias and Dal (2006) examine how Hispanic ethnicity affects short-term (6 month) and longer-term (45 month) attrition, retention past the first term of service and promotion to E4. The authors use individual demographic and performance data from DMDC to follow 1.9 million active duty enlistees from all services who accessed from 1992 to 2001. Using a unique identifier, they were able to follow the service members

from entry to separation or the end of the data period. The purpose of the research was two-fold: to identify reoccurring themes that will raise awareness of the uniqueness of the Hispanic population and analyze the performance of Hispanics in the military.

## 1. Methodology

The authors use a two-step methodology. First, they conduct semi-structured interviews using open ended questions in an informal conversational form with Hispanic U.S. Navy officers, high school guidance counselors and high school JROTC instructors to generate a broad understanding of how Hispanic youth view military service. Next, they estimate a multivariate probit regression to estimate the effects of the variables of interest on the probability of short-term (6 months) and longer-term (45 month) attrition and on reenlistment and promotion.

## 2. Model

The authors specify probit regression models (Equations 3–5) to estimate effects of explanatory variables on attrition (early and first term), reenlistment and promotion.

$$[3] \quad Pr(Attrition = 1 | X) = \beta_0 + \beta(Demographic Factors) + \theta(Individual Factors) + \mu$$

$$[4] \quad Pr(Reenlist = 1 | X) = \beta_0 + \beta(Demographic Factors) + \theta(Individual Factors) + \mu$$

$$[5] \quad Pr(E4promotion = 1 | X) = \beta_0 + \beta(Demographic Factors) + \theta(Individual Factors) + \mu$$

For all models, demographic factors include Hispanic country of origin, race, citizenship, age, gender, marital status and number of dependents. For the attrition models, individual factors include education credential tier, AFQT percentile and accession pay grade. For the retention model, individual characteristics include educational credential tier, AFQT percentile, cohort year, end of contract pay grade, MOS and home of record unemployment rate. For the promotion model, individual characteristics include education credential tier, AFQT percentile, accession pay grade and MOS. The reference category for all models is a single, white, male with a Tier 1 education credential and U.S. citizenship. The authors use accession pay grade E1 as the

reference category for the attrition and promotion models and end of contract pay grade E1 for the retention model. The authors use cohort 1993 as the reference category for the reenlistment model. It is unclear from the study which MOS were used as reference categories for the retention and promotion models.

### 3. Results

The authors discuss the results for all four models in their research. Tables 8 and 9 list the mean attrition, reenlistment and promotion rates for Hispanics and non-Hispanics in all four services and separately for the Marine Corps and the results of t-tests of group means. Consistent with other research, the t-tests indicate that attrition rates for Hispanics are significantly lower than for non-Hispanics. Based on the t-tests, reenlistment and promotion rates for Hispanics are also significantly higher than for non-Hispanics.

Table 8. Mean Characteristics of Hispanics, Non-Hispanics and Enlistees in all Services (after Arias & Dal, 2006)

Outcome	All	Hispanic	Non-Hispanic	Difference t-value (calculated)
6 Month Attrition Rate	34.06%	22.89%	34.87%	-99.71
45 Month Attrition Rate	43.55	30.73	44.47	-104.57
Reenlistment Rate	39.73	45.42	39.32	43.31
Promotion to E4 Rate	44.12	52.25	43.53	61.66

Table 9. Mean Characteristics of Hispanics, Non-Hispanics and Enlistees in the Marine Corps (after Arias & Dal, 2006)

Outcome	All	Hispanic	Non-Hispanic	Difference t-value (calculated)
6 Month Attrition Rate	19.28%	4.04%	20.93%	-134.03
45 Month Attrition Rate	31.80	13.73	33.77	-100.29
Reenlistment Rate	19.90	28.13	19.00	36.90
Promotion to E4 Rate	47.86	61.67	46.36	56.41

The empirical model the authors use to estimate the effects of determinants on 45-month attrition is most relevant to my research. The overall mean 45-month attrition rate in the Marine Corps is 31.8%, but is 13.7% for Hispanics versus 33.8% for non-Hispanics. Arias and Dal find that ethnic background, race, gender, marital status, number of dependents, AFQT percentile, educational tier and enlistment rank are statistically and practically significant determinants of 45-month attrition (Table 10).

Among Hispanics in the Marine Corps, the authors find the largest effect on attrition is for recruits with a Mexican ethnic background. Compared to whites, Hispanics from Mexico are 17.1 ppts (53.8%) less likely to attrite within the first 45 months. The smallest effect occurs among Hispanic recruits with a Cuban background, who are 9.6 ppts (30.2%) less likely to attrite than whites. Although a negative effect among all Hispanic backgrounds is consistent across the four services, the size of the individual effects differs. The Marine Corps is the only service where the largest effect occurs among Hispanics from Mexico. In the Army and the Navy, the largest effect occurs among Hispanics from Latin America. In the Air Force, the largest effect occurs among Hispanics from Puerto Rico.

Unlike Wenger and Hodari (2004), the authors find that across services, Blacks are less likely to attrite than Whites. For example, in the Marine Corps, Blacks are 13.8 ppts (43.4%) less likely to attrite. Consistent with other studies, the authors find that females experience higher attrition than males. In the Marine Corps, females are 8.3 ppts (26.1%) more likely to attrite. But, this effect is not consistent among services, In the Navy, females are 3.5 ppts (8.0%) *less* likely to attrite.

In the Marine Corps, recruits who are married at enlistment are 12.7 ppts (39.9%) more likely to attrite than single recruits, but increasing the number of dependents lowers probability of attrition. Tier 1 recruits and recruits with higher AFQT percentiles have lower estimated probabilities of attrition. In the Marine Corps, a recruit with a Tier 2 credential is 1.9 ppts (5.8%) more likely to attrite than a recruit with a Tier 1 credential. A recruit with a Tier 3 credential is 12.6 ppts (39.6%) more likely to attrite. The effect of a Tier 2 credential is lower in the Marine Corps than it is in the Army or Navy. In the

Army, a recruit holding a Tier 2 credential is 14.4 ppts (33.0%) more likely to attrite than one holding a Tier 1 credential.

Currently, in the Marine Corps, non-Prior Service recruits can only access as a Private (E1) or PFC (E2) (HQMC, 2004). The authors find that recruits who enlist as a PFC are 5.9 ppts (18.6%) less likely to attrite than recruits who enlist as Privates.

Table 10. Partial Effects for First Term (45-Month) Attrition Models  
(from Arias & Dal, 2006)

Variables	Army	Navy	Air Force	Marine Corps
Mexican	-0.1728 (0.0058)***	-0.2269 (0.0043)***	-0.1192 (0.0028)***	-0.1708 (0.0025)***
Other Hispanic	-0.1701 (0.0057)***	-0.1451 (0.0033)***	-0.0548 (0.0040)***	-0.1267 (0.0036)***
Puerto Rican	-0.1924 (0.0063)***	-0.2379 (0.0065)***	-0.1194 (0.0043)***	-0.134 (0.0061)***
Cuban	-0.1006 (0.0275)***	-0.0654 (0.0187)***	-0.1055 (0.0160)***	-0.0958 (0.0202)***
Latin American	-0.2004 (0.0108)***	-0.2458 (0.0112)***	-0.0907 (0.0159)***	-0.133 (0.0076)***
Asian	-0.2314 (0.0054)***	-0.2761 (0.0037)***	-0.1174 (0.0029)***	-0.193 (0.0038)***
Black	-0.178 (0.0022)***	-0.1764 (0.0019)***	-0.0703 (0.0016)***	-0.138 (0.0021)***
Other	-0.1747 (0.0051)***	-0.2056 (0.0120)***	-0.0952 (0.0044)***	-0.1655 (0.0052)***
Indian/Alaskan	-0.169 (0.0095)***	-0.1743 (0.0055)***	-0.0651 (0.0070)***	-0.1346 (0.0062)***
White	BASE	BASE	BASE	BASE
Female	0.0842 (0.0025)***	-0.0352 (0.0019)***	0.0284 (0.0016)***	0.0833 (0.0038)***
Male	BASE	BASE	BASE	BASE
Married	0.0285 (0.0028)***	-0.0674 (0.0023)***	0.0152 (0.0019)***	0.1274 (0.0040)***
Single	BASE	BASE	BASE	BASE
Age	0.0261 (0.0003)***	0.0103 (0.0002)***	0.0095 (0.0003)***	0.0096 (0.0004)***
AFQT Percentile	-0.021	-0.0214	-0.0208	-0.0208

Variables	Army	Navy	Air Force	Marine Corps
	(0.0001)***	(0.0000)***	(0.0000)***	(0.0000)***
Number of Depend	-0.0109	0.029	-0.0363	-0.0971
	(0.0011)***	(0.0009)***	(0.0008)***	(0.0016)***
Tier 2	0.1436	0.1504	0.0938	0.0185
	(0.0026)***	(0.0022)***	(0.0019)***	(0.0038)***
Tier 3	0.1449	0.1565	0.1033	0.126
	(0.0046)***	(0.0034)***	(0.0059)***	(0.0070)***
Tier 1	BASE	BASE	BASE	BASE
Non-citizen	-0.1827	-0.0856	0.0485	0.018
	(0.0076)***	(0.0039)***	(0.0060)***	(0.0047)***
U.S. Citizen	BASE	BASE	BASE	BASE
E2	-0.0003	-0.0023	-0.0373	-0.0599
	-0.0028	-0.0019	(0.0016)***	(0.0020)***
E3	-0.0638	-0.0399	-0.0721	-0.2126
	(0.0029)***	(0.0020)***	(0.0017)***	(0.0020)***
E4	-0.1522	-0.0469	-0.2038	-0.2605
	(0.0030)***	(0.0025)***	(0.0014)***	(0.0018)***
E5	-0.2037	-0.2127	-0.2062	-0.277
	-0.0043	(0.0031)***	(0.0024)***	(0.0020)***
E1	BASE	BASE	BASE	BASE
Observations	331704	596374	433317	307791

#### 4. Evaluation

Arias and Dal's study has a number of strengths. First, they include a large sample of enlistees from all services that covered 10 cohort years and they were able to track recruits throughout their careers. Also, they estimate separate logistic regressions for each service allowing comparison of effects of the determinants across services. Next, the authors control for Hispanic country of origin. As noted earlier, the Hispanic ethnicity is an umbrella term that includes people from a number of diverse backgrounds and countries. Controlling for country of origin provides additional granularity to a heterogeneous group. Finally, they controlled for MOS. It is hypothesized that MOS can significantly affect promotion and retention. More technical fields with longer MOS schools are thought to promote to E4 faster and retain more Marines than the combat arms MOS because of disparate organizational structures (W. Hatch, lecture, 6 August

2014). This is also one of the weaknesses of the study. The authors discover that many MOS have a significant effect on retention and promotion, but make no attempt to group MOS by role (i.e., Combat Arms, Support, Aviation Support, or occupational field). Neither do the authors attempt to analyze these results for trends related to ethnicity.

#### **D. HATTIANGADI, LEE AND QUESTER (2004)**

Hattiangadi et al. attempt to determine factors contributing to the success of Hispanic and non-Hispanic Marines in completing boot camp and their first term of service. In order to do this, the authors analyze demographic, accession and retention data received from DMDC for 721,259 Marine Corps accessions from 1979–2001. Because waiver data was unavailable from 1979–1991, the authors analyze the data over the entire period and for 1992–2001 when waiver data was available. The purpose of the study was twofold: to identify challenges that may affect the Marine Corps' ability to recruit Hispanics in the future and to recommend actions the Marine Corps can take to ensure the continued success of Hispanic recruits

##### **1. Methodology**

Hattiangadi et al. use a multi-step methodology to meet their objectives. After identifying relevant demographic trends in the U.S. population at large and representation and propensity trends in the military, the authors conduct a qualitative analysis. First, they visit Marine Corps Recruiting Stations in heavily Hispanic areas like Texas, Southern California, Chicago, Florida and New York to identify the general Marine recruiting process and determine how the process affects Hispanic recruitment. Next, they visited the Marine Corps Recruit Depots (MCRD) in San Diego and Parris Island, SC where they interviewed Series Commanders, Drill Instructors and Hispanic recruits to identify possible reasons for Hispanic success in recruit training and later in the operating forces. Finally, the authors use a multivariate logistic regression to estimate the effects of the variables of interest on the probability of short-term (recruit training) and longer-term (45 month) attrition from the Marine Corps.

## 2. Model

The authors estimate different models (Equation [6]) for the entire sample period and the abbreviated sample period which was restricted due to data availability (1992–2001). Each model estimates effects on recruit training attrition and 45-month attrition for four sub-samples: Hispanic Male, Hispanic Female, non-Hispanic Male and non-Hispanic Female.

$$[6] \quad \begin{aligned} Pr(Attrition = 1 | X) = & \beta_0 + \beta_1(Race / Ethnicity) + \beta_2(Accession Characteristics) \\ & + \beta_3(Individual Characteristics) + \beta_4(cohort) + \mu \end{aligned}$$

For both models, race characteristics include White, Black Asian-Pacific Islander and Other. Ethnicity characteristics are separated by Hispanic background, including Mexican, Cuban, Latin American, Puerto Rican and Other Hispanic background. Accession characteristics include dichotomous variables for summer accessions, DEP participation and DEP participation greater than or equal to three months. Individual characteristics include dichotomous variables for Tier 1 education credential, “High Quality” identifier, shipment to MCRD Parris Island and meeting retention weight. (A “High Quality” recruit is someone who holds a Tier 1 and scores in the 50th percentile or higher on the AFQT.) For the abbreviated sample period the authors include variables for receipt of college fund and receipt of enlistment bonus as accession characteristics and citizenship as an individual characteristic. The cohort dummy variables are created for the fiscal year the recruit first began recruit training. For all estimates white race is the reference category. For estimates using the entire sample period, FY1979 is the reference category. When the restricted sample period is used, FY1992 is the reference category.

## 3. Results

The results are displayed in Tables 11–13. The authors note that the results are strikingly similar whether estimated for the entire sample period or the restricted sample period. Although results from all 16 regression estimates are reported in their appendices, the authors only discuss results from the restricted sample (1992–2001). The authors also note that many of the variables of interest are statistically significant for men, but insignificant for women. From their analysis they conclude women have higher attrition

rates than men and female attrition is more difficult to explain using recruit characteristics than male attrition.

The mean bootcamp attrition rate (Table 11) for Hispanic males is 8.6% compared to 13.1% for non-Hispanic males. The mean bootcamp attrition rate (Table 11) for Hispanic females is 14.7% compared to 22.8% for non-Hispanic females. Similar to other studies, Hatiangadi et al. find that ethnicity, educational tier, recruit quality, and time in DEP are all statistically and practically significant determinants of attrition.

In Tables 12 and 13 Hispanic country of origin variables have lower estimated probabilities of attrition than for whites. For male bootcamp attrition (Table 12), the effect ranges from a 5.1 ppt (40.5%) reduction in estimated probability for Hispanics from Mexico to a 2.8 ppt (22.2%) reduction for Hispanics from Puerto Rico. Also in Table 13, Tier 1 males have a 4.4 ppt (34.9%) lower estimated probability of boot camp attrition than Tier 2 or Tier 3 males. High quality males have a 2.9 ppt (23.0%) lower estimated probability of bootcamp attrition than non-high quality males. Males who spend at least three months in DEP have a 3.0 ppt (23.8%) lower estimated probability of bootcamp attrition than those who spend less than three months in DEP. Unlike Arias and Dal (2006), the authors find that regardless of ethnicity, non-citizens have a lower estimated probability of bootcamp or 45-month attrition than citizens. In Table 12, male non-citizens have a 3.7% (29.4%) lower estimated probability of experiencing bootcamp attrition than male citizens.

The authors also find that recruits shipped to MCRD San Diego and summer accessions (June through September) have lower estimated probabilities of attrition than recruits shipped to MCRD Parris Island and non-summer accessions, respectively. The practical significance of recruit depot location varies greatly depending on the sample and type of attrition. In Table 11, Hispanic males who train at Parris Island have a 1.1 ppt (12.8%) higher estimated attrition rate than Hispanic males who train in San Diego. Non-Hispanic males, however only have a .3 ppt (2.3%) difference if they train at Parris Island. In Table 12, the effect of Parris Island training for males overall is -.4 ppt (3.1%) for boot attrition, but the effect is much larger, 2.3 ppt (7.3%), for first term attrition.

Table 11. Marginal Effects on Hispanic and Non-Hispanic Bootcamp Attrition, FY1992 to FY2001 (from Hatiangadi et al., 2004)

Independent variable	Male accessions		Female accessions	
	Hispanic	Non- Hispanic	Hispanic	Non- Hispanic
Tier I	-0.039	-.045**	not sig	not sig
High quality	-.012**	-.031**	not sig	-.047**
Meets retention weight	-.031**	-.049**	not sig	not sig
DEP	not sig	not sig	not sig	not sig
DEP ge 3 months	-.017**	-.032**	-.063**	-.048**
June through Sept accession	-.015**	-.018**	-.039**	-.029**
Enlistment waiver	.014**	.015**	.043**	not sig
College Fund	not sig	-.037**	not sig	-.057**
Enlistment bonus	not sig	-.007**	not sig	not sig
Parris Island	.011*	.003**	NA	NA
Non-citizen	-.027**	-.045**	-.027**	-.106**
Mean bootcamp attrition	0.086	0.131	0.147	0.228
Number of observations	35,307	269,916	2,654	17,989
(** indicates statistical significance at the 1-percent level, * indicates statistical significance at the 5-percent level)				

Table 12. Marginal Effects on Bootcamp Attrition, FY1992 to FY 2001  
 (from Hattiangadi et al., 2004)

Independent variable	Men	Women
Tier I	-.044**	not sig
High quality	-.029**	-.043**
Parris Island	.004**	NA
Meets retention weight	-.047**	not sig
DEP	not sig	not sig
DEP greater than or equal to 3 months	-.030**	-.050**
June through Sept accession	-.018**	-.029**
Enlistment waiver	.015**	not sig
College Fund	-.035**	-.050**
Enlistment bonus	-.006**	not sig
Non-citizen	-.037**	-.070**
Race/ethnic background		
API	-.033**	-.044**
Black	-.015**	-.031**
Other race/ethnic background (non-Hispanic)	-.024**	-.044**
Cuban	not sig	not sig
Latin American	-.047**	-.092**
Mexican	-.051**	-.091**
Puerto Rican	-.028**	-.043*
Other Hispanic background	-.041**	-.053**
Average attrition rate	0.126	0.218
Number of observations	305,230	20,643

Table 13. Marginal Effects on 45-Month Attrition, FY1992 to FY 1998 (from Hattiangadi et al., 2004)

Independent variable	Men	Women
Tier I	-.099**	-.085**
High quality	-.056**	-.035**
Parris Island	.023**	NA
Meets retention weight	-.067**	-0.023
DEP	-0.006	0.002
DEP ge 3 months	-.059**	-.067*
June through Sept accession	-.021**	-.032**
College Fund	-.065**	-.042**
Enlistment bonus	-.023**	.031**
Enlistment waiver	.057**	.020**
Non-citizen	-.082**	-0.14**
Race/ethnic background		
API	-.071**	-.121**
Black	.000	-.100**
Other race/ethnic background (non-Hispanic)	-.025**	-.082**
Cuban	-0.023	-0.008
Latin American	-.090**	-.095**
Mexican	-.108**	-.162**
Puerto Rican	-.035**	-.108*
Other Hispanic background	-.085**	-.091**
Mean first-term attrition rate	0.316	0.453
Number of observations	216,924	13,982

#### 4. Evaluation

One of the strengths of this analysis is that the authors estimate the marginal effects of independent variables specifically on Marine Corps attrition, instead of on attrition for all four services. They also recognize that the effects of the variables of interest may not be identical for Hispanics and non-Hispanics and estimate separate models for both major ethnicity groups. Finally, the authors identify through their interviews that attrition is lower for recruits who access during the summer months and train in San Diego. These qualitative discoveries are supported by their quantitative analysis.

The authors, however, omit explanatory variables that other studies have shown to be statistically significant. These variables include marital status, number of dependents and age. Omitting these variables opens the door for omitted variable bias. Also, the authors' use of "High Quality" as an independent variable is highly correlated with tier 1 educational credential. Separating AFQT percentile from educational tier may reduce the inherent multicollinearity.

## **IV. DATA AND METHODOLOGY**

### **A. INTRODUCTION**

The purpose of this chapter is twofold. First, I will discuss the source of the data used in this study, describe how the data was cleaned and coded to achieve its final form, summarize the final data set and provide descriptive statistics describing the differences between Hispanic and non-Hispanic enlistees. Next, I will describe the methodology used in the next chapter to analyze the data in depth.

### **B. DATA SOURCE**

The data for this research comes from TFDW, which is the Marine Corps' official system for end strength reporting and manpower data archive. It consolidates manpower and personnel data from over 20 Marine Corps and DOD data systems, including the Marine Corps Total Force System (MCTFS), the Marine Corps Recruiting Information Support System (MCRISS) and the Marine Corps Training Information Management System (MCTIMS) (TFDW, 2015). TFDW pulls data from all sources on a monthly basis on the last day of the month. It stores more than 30 years of these monthly "snapshots," allowing data users to follow individual Marines from accession through separation or retirement (TFDW, 2015). Within TFDW, data is organized by table and sequence number. Tables are groupings of similar data from the same source. For instance, PFT data from MCTIMS, CFT data from MCTIMS and accession data from MCRISS are all located in different tables (TFDW, 2015). Sequence numbers are sequential numbers assigned by TFDW to each monthly snapshot. For instance, the sequence number 310 was assigned to all data pulled on 31 December 2014 and sequence number 311 to all data pulled on 31 January 2015 (TFDW, 2015).

For this research, data was obtained from TFDW on 232,634 Marine Corps enlistees who accessed between FY2003 and FY2009. Enlistees are grouped by the fiscal year they shipped to boot camp and assigned to a cohort based on that fiscal year. Each enlistee is also assigned a unique identification number based on his or her social security number. For this research, initial observations for the variables were obtained in each

table for each identification number for a given cohort. Any time a monthly snapshot revealed that the information for a specific identification number had changed, all variables in that snapshot were saved for the affected individual. I received 19 tables of data for seven cohorts of enlistees. I follow new accessions who entered between FY2003 and FY2006 for eight years of service. Since all data collected ended in FY2014, I reduce my observation period for new accessions between FY2007 and FY2009 to only five years of service.

## C. DATA CLEANING AND CODING

### 1. Recruit Data

I use information from the “MCRISS” table to determine which identification numbers are associated with each cohort. Marine Corps Recruiting Command (MCRC) must process every Marine who ships to a recruit depot. Since MCRISS is the official information system for MCRC, it contains the most accurate data regarding the MCRC recruiting process. Also, since most individuals only access through MCRC once, very few individuals have multiple rows of data in the MCRISS table. Of the identification numbers that do have multiple entries, height, weight, home of record and recruit training disposition information provided by the MCRISS table facilitate determining if those recruits accessed through MCRC more than once or if the same identification number was assigned to multiple individuals. Using the MCRISS table as the base table ensures that the variables in all other tables are associated with the correct individual identification number.

Of the 232,674 recruits obtained from TFDW in the raw data sample, I keep only the 212,999 recruits who were assigned a “non-prior service active duty” component code. I drop 7,691 recruits who were discharged from the DEP and never shipped to a recruit depot. I drop an additional 748 observations with a pay entry base date outside of my observation period, with a recruit depot discharge and re-accession in the same year, or with an identification number assigned to multiple distinct individuals (different height, weight and home of record). For recruits who accessed multiple times in the same fiscal year, I keep the most recent observation.

Education background, ASVAB scores, initial strength test (IST) score and recruit depot destination data come from the MCRISS table and are useable in their raw form. The only exception is the upper body score for the IST. The IST requires that men perform pull-ups, measured in number and that women perform a flex arm hang, measured in seconds, to demonstrate upper body strength. I create a uniform scoring metric for both men and women equivalent to the metric HQMC uses to assess the PFT. Each pull-up performed is worth five points up to a maximum of 100 points. Each second of flex arm hang time is worth one point up to 40 seconds. Each second of flex arm hang time from 40 to 70 seconds is worth two points up to a maximum of 100 points (HQMC, 2008).

BMI is calculated from MCRISS height and weight data using the CDC's standard measurement formula. I calculate BMI on the contract date (when the recruit enters the DEP) and at ship date (when the recruit leaves for recruit training). "Obese" and "Overweight" definitions are based on CDC standards (CDC, 2014). If a recruit has a BMI greater than or equal to 25 but less than 30 at the time of measurement, I label him "overweight." If his BMI is greater than or equal to 30, the recruit is defined as obese.

"Open contract" is a dummy variable generated from the bonus program and skill program information in the MCRISS table. Skill programs are enlistment incentives offered to a potential recruit guaranteeing assignment to an MOS or occupational field contingent on successful completion of a required course of training (HQMC, 2012). Bonus programs are monetary enlistment incentives that may be contingent on a recruit successfully completing a required course of training or shipping to recruit training at certain times of the year (HQMC, 2012). A recruit is labeled as an "open contract" if he fails to enlist with a skill program or bonus program identifier.

"Advanced paygrade" is a dummy variable used to identify recruits who enlisted at a paygrade higher than E1. "Advanced paygrade" takes a value of 1 if the enlistee's E2 date of rank or E3 date of rank equals the date he shipped to recruit training, otherwise it takes a value of 0.

Waivers are categorized based on their waiver category description and 96% of observed waivers fall into one of four categories: “Drug Involvement,” “Law Violations,” “Medical/Physical,” or “USMC Admin/Unique.” TFDW generates a row of data for each waiver for each individual. I create a dummy variable for each major waiver category for each individual. The dummy variable takes the value of 1 if the waiver category description equals the applicable criterion, 0 otherwise. I then sum the waiver dummy variables for each individual identification number to generate a total number of waivers for each major waiver category.

## **2. Demographic Data**

I use the “Demographics” table to obtain information on gender, race, ethnicity, citizenship, marital status and number of dependents. Some demographic data (e.g., marital status) can change during a Marine’s career. I use the first TFDW snapshot to determine demographic characteristics at entry. For variables that change over time in the dataset, such as self-reported ethnicity, citizenship, marital status and number of dependents, I use the closest TFDW snapshot to the Marine’s fifth year of service. For Marines who were discharged before serving five years, I use the last recorded snapshot.

## **3. Performance and Occupation Data**

I calculate average PFT and average CFT scores based on the average scores on PFTs or CFTs during a Marine’s career. Prior to finding the average, I drop all PFT and CFT scores that have a PFT/CFT class code of 5, 6, 8 or 9, which indicate that last recorded score was duplicated for medical or administrative reasons (HQMC, 2008).

Average proficiency markings in service and average conduct markings in service are taken from the “Pros/Cons” table and are useable in their raw form. Average rifle qualification score is taken from the “Rifle” table. Rifle qualification scores from FY 2009 and later are based on the 350 point scale and useable in their raw form. Rifle qualification scores from FY 2007 and earlier were based on a 250 point scale. To convert the FY07 and earlier scores to a 350 point scale, I use the line of best fit created by comparing the respective point cutoffs used to convert rifle qualification scores to composite score ratings (Table 23, Appendix C). The relationship between the two scales

is nearly linear. The line of best fit is  $1.78x - 90.3$ . Scores from FY 2008 had a bimodal distribution with modes at approximately 220 and 310, indicating that two scoring scales were used for rifle marksmanship evaluation that year. I convert scores that were less than 250 points and were not assigned an “Unqualified” rifle qualification (any score below 250 points on the 350 point scale is considered failing) (HQMC, 2014). All other scores were left in their raw form. All “Unqualified” rifle class codes were associated with a score of zero in the database. I replace these zeros with a value of 224 (90% of the highest failing score) to limit the influence one failure has on an individual’s mean score. (My analysis of PFT and CFT data indicates the average failing score was approximately 90% of the highest failing score.)

“Weight control assignment” is a dummy variable generated from the “weight control assignment quantity” variable in the “Training/Qualification” table. The weight control assignment variable takes the value of 1 if a Marine has a weight control assignment quantity greater than or equal to one. Otherwise, the variable takes the value 0. A Marine will have a weight control assignment quantity if he was assigned to the Marine Corps Body Composition Program. This assignment occurs if a Marine exceeds the maximum weight requirement based on his height and his body fat percentage exceeds the maximum allowable body fat based on his age (HQMC, 2008a).

One of the unique features of this thesis is the use of a metric to assess and differentiate the performance of individual Marines. I create a continuous variable “Success Score”, which is based on several different variables in the data set. “Success Score” in this thesis is based on the “Quality Score” metric used to assign reenlistment eligible Marines to performance tiers (Crider, 2015) and a function of variables similar to those used to compute a Marine’s Composite Score (Appendix C). The Marine Corps’ “Quality Score” is equal to the sum of a Marine’s most recent PFT Score, most recent CFT score, most recent Rifle Qualification score, average proficiency in service score x 100 and average conduct in service score x 100. 100 points are added to the “Quality Score” if the Marine was meritoriously promoted to his current rank. An additional 0 to 100 points is added to the score depending on the Marines current Marine Corps Martial Arts Program (MCMAP) qualification (Crider, 2015).

As shown in Equation 7, “Success Score” in this thesis is a function of average PFT, average rifle score, average proficiency in service and average conduct in service and meritorious promotion to E3, E4 or E5 (Figure 10). Unlike the “Quality Score,” I do not use CFT or MCMAP in the calculation of “Success Score” I omit CFT scores from the function because 37.5% of the observed identification numbers were missing CFT score data. Furthermore, the correlation between PFT score and CFT score is weak making prediction of CFT score from PFT data inaccurate. I omit MCMAP data from the function due to lack of data availability. Furthermore, I use first term averages of the selected variables to calculate “Success Score” instead of using data from a snapshot taken during the first term like the “Quality Score.” “Success Score” is different from the Composite Score because it does not use seniority, self-education or recruit referrals in its calculation.

$$(7) \quad \begin{aligned} success\_score = & 2 * avg\_pft + avg\_rifle + 10 * avg\_proficiency\_service \\ & + 10 * avg\_conduct\_service + 100 [if(meritorious = 1)] \end{aligned}$$

Reenlistment bonus information is taken from the “Reenlistment” table and is useable in its raw form. Reenlistment recommendation is a dummy variable generated from the reenlistment recommendation code variable in the “Reenlistment” table. The reenlistment recommendation variable takes the value 1 if the Marine has a reenlistment recommendation description “recommended and eligible” (coded 1A). Otherwise, the reenlistment recommendation variable takes the value 0. “Reenlist” is a dummy variable that takes the value 1 if a Marine has a reenlistment date and 0 if the reenlistment date is missing.

I calculate TIS by subtracting the separation date from the armed forces active duty base date (AFADBD). If a Marine does not have a separation date, I assume he has not separated from the Marine Corps and assign him a separation date equal to his AFADBD plus eight years. For 106 observations, TFDW had the separation date equal to the enlistment date or shipping date. In order to prevent a negative or zero TIS in these cases, I replace the separation date with a date equal to the first reenlistment date plus three years. If this new separation date exceeds the AFADBD plus eight years, I replace the generated separation date with one equal to the AFADBD plus eight years. If the

Marine did not reenlist, I replace the separation date with the first reenlistment recommendation date, which coincides with the separation or reenlistment date for most of the Marines in the data set.

To obtain TIS in months, I divide TIS by 30.417. I define “early attrition” as TIS less than or equal to 12 months. I define “first-term attrition” as TIS greater than 12 months, but less than 45 months. I define “any attrition” as TIS less than 45 months.

I calculate total days deployed by summing total Global War on Terrorism (GWOT) combat days deployed and total GWOT non-combat days deployed from the “deploy” table. I calculate deployed percentage by dividing total days deployed by TIS (calculated in days).

Primary MOS (PMOS) is found on the “Rank/MOS” table. PMOS is subject to change until a Marine graduates from his technical training. When a recruit arrives at the recruit training depot, he is assigned a 9900 PMOS (HQMC, 2013). When he arrives at his technical training school, he is assigned a basic MOS, e.g., 0300 for “Basic Infantryman” (HQMC, 2013). Once he graduates from technical training, he is assigned his job specific MOS, e.g., 0311 for “Rifleman” (HQMC, 2013). I generate PMOS using the last TFDW snapshot prior to a Marine’s promotion to E3. I determine the OccFld based on the first two digits of the PMOS. More than 95% of observations were assigned a general or specific PMOS when that snapshot was taken.

Combat arms MOS are those MOS that were restricted to males prior to 2013. The combat arms MOS are in the “3xx, 08xx or 18xx OccFlds (HQMC, 2011). Special Duty Assignment (SDA) is a dummy variable generated from the billet MOS variable on the “reenlistment” table. The SDA variable takes the value 1 if a Marine has an SDA MOS (described in Chapter II.F) as his billet MOS at reenlistment. Otherwise, the SDA variable takes the value 0.

Definitions of the variables created for the analysis are displayed in Table 14.

Table 14. Variable Definitions

Variable	Definition
<b>Dependent Variables</b>	
Any attrition	=1 if tis month <45; otherwise =0
Success Score	=2*Avg PFT+Avg Rifle+ Avg Proficiency Service+Avg Conduct Service+100 (if meritoriously promoted to E3, E4 or E5)
reenlist	=1 if not missing reenlistment date; otherwise =0
<b>Demographic Variables</b>	
female	=1 if sex=female; otherwise =0
Hispanic entry	=1 if ethnicity at entry=Hispanic; otherwise =0
Hispanic five YOS	=1 if ethnicity at separation or five year mark=1; otherwise=0
Black	=1 if race=Black or African American; otherwise =0
Asian	=1 if race=Asian; otherwise=0
AIAN	=1 if race=American Indian or Alaska Native; otherwise=0
NHPI	=1 if race=Native Hawaiian or other Pacific Islander; otherwise=0
decline race	=1 if race=Declined to Respond; otherwise=0
alien	=1 if citizenship=Alien; otherwise=0
married entry	=1 if marital_status at entry=Married; otherwise=0
# dependents entry	=number of dependents at entry
married five YOS	=1 if marital_status at separation or five year mark=Married; otherwise=0
# dependents five	= number of dependents at separation or five year mark
<b>Recruit Variables</b>	
Tier 1	=1 if education_Tier at_contract=1; otherwise=0
Tier 2	=1 if education_Tier at_contract=2; otherwise=0
Tier 3	=1 if education_Tier at_contract=3; otherwise=0
AFQT	=afqt percentile value
AR+MK	=sum of arithmetic reasoning and math knowledge ASVAB subtest scores
IST Upper Body Strength	=upper body score of initial strength test
IST Run Time	=initial strength test 1.5 mile run time (minutes)
IST Crunches	=number of crunches performed on the initial strength test
Open Contract	=1 if missing skill program and missing bonus program; otherwise =0
MRCD Parris Island	=1 if enlistee shipped to MCRD Parris Island; otherwise=0
Advanced Pay Grade	=1 if enlistee was an E2 or E3 at ship date; otherwise=0

Variable	Definition
<b>Recruit Variables</b>	
Drug Waiver	=number of drug waivers at enlistment
Law Waiver	=number of law violation waivers at enlistment
Unique Waiver	=number of administrative or unique waivers at enlistment
Medical Waiver	=number of medical or physical waivers at enlistment
BMI at Contract Date	=body mass index at enlistment
BMI at Ship Date	= body mass index at ship
Overweight Contract Date	=1 if BMI>=25 at enlistment; otherwise=0
Overweight at Ship Date	=1 if BMI >=25 at ship; otherwise=1
Obese at Contract Date	=1 if BMI >=30 at enlistment; otherwise=0
Obese at Ship Date	=1 if BMI >=30 at ship; otherwise=1
<b>Performance Variables</b>	
Ever Deployed	=1 if enlistee was awarded a Sea Service Deployment Ribbon or Global War on Terrorism Expeditionary Medal; otherwise =0
Deployed Pct	=(total number of GWOT combat days deployed + total number of non-combat GWOT days deployed)/tis_days
Avg PFT	=enlistee's mean PFT score
Avg CFT	=enlistee's mean CFT score
Avg Proficiency Service	=enlistee's mean proficiency score through the rank of E4
Avg Conduct Service	=enlistee's mean conduct score through the rank of E4
Avg Rifle	=mean rifle qualification score (FY07 and earlier scores converted to a 350 point scale)
Recommend Reenlist	=1 if reenlistment recommendation description=Recommended and Eligible; otherwise=0
Reenlist Bonus (\$,000)	=amount of first reenlistment bonus(thousands of dollars)
<b>Occupational Fields</b>	
OccFld 2	=1 if OccFld=02(Intelligence); otherwise =0
OccFld 3	=1 if OccFld=03(Infantry); otherwise =0
OccFld 4	=1 if OccFld=04 (Logistics); otherwise =0
OccFld 5	=1 if OccFld=05 (Marine Air Ground Task Force Plans); otherwise =0
OccFld 6	=1 if OccFld=06 (Communications); otherwise =0
OccFld 8	=1 if OccFld=08 (Artillery); otherwise =0
OccFld 11	=1 if OccFld=11 (Utilities); otherwise =0
OccFld 13	=1 if OccFld=13 (Engineer, Construction, Facilities and Equipment); otherwise =0

Variable	Definition
<b>Occupational Fields</b>	
OccFld 18	=1 if OccFld=18 (Tank and Assault Amphibious Vehicle); otherwise =0
OccFld 21	=1 if OccFld=21 (Ground Ordnance Maintenance); otherwise =0
OccFld 23	=1 if OccFld=23 (Ammunition and Explosive Ordnance Disposal); otherwise =0
OccFld 26	=1 if OccFld=26 (Signals Intelligence/Ground Electronic Warfare); otherwise =0
OccFld 28	=1 if OccFld=28 (Ground Electronics Maintenance); otherwise =0
OccFld 30	=1 if OccFld=30 (Supply Administration and Operations); otherwise =0
OccFld 31	=1 if OccFld=31 (Distribution Management); otherwise =0
OccFld 33	=1 if OccFld=33 (Food Service); otherwise =0
OccFld 34	=1 if OccFld=34 (Financial Management); otherwise =0
OccFld 35	=1 if OccFld=35 (Motor Transport); otherwise =0
OccFld 43	=1 if OccFld=43 (Public Affairs); otherwise =0
OccFld 44	=1 if OccFld=44 (Legal Services); otherwise =0
OccFld 46	=1 if OccFld=46 (Combat Camera); otherwise =0
OccFld 55	=1 if OccFld=55 (Music); otherwise =0
OccFld 57	=1 if OccFld=57 (Chemical, Biological, Radiological and Nuclear Defense); otherwise =0
OccFld 58	=1 if OccFld=58 (Military Police); otherwise =0
OccFld 59	=1 if OccFld=59 (Aviation Command/Control Electronics Maintenance); otherwise =0
OccFld 60	=1 if OccFld=60 (Aircraft Maintenance); otherwise =0
OccFld 61	=1 if OccFld=61 (Aircraft Maintenance [Rotary Wing]); otherwise =0
OccFld 62	=1 if OccFld=62 (Aircraft Maintenance [Fixed Wing]); otherwise =0
OccFld 63	=1 if OccFld=63 (Organizational Avionics Maintenance); otherwise =0
OccFld 64	=1 if OccFld=64 (Intermediate Avionics Maintenance); otherwise =0
OccFld 65	=1 if OccFld=65 (Aviation Ordnance); otherwise =0
OccFld 66	=1 if OccFld=66 (Aviation Logistics); otherwise =0
OccFld 68	=1 if OccFld=68 (Meteorology and Oceanography); otherwise =0
OccFld 70	=1 if OccFld=70 (Airfield Services); otherwise =0

Variable	Definition
Occupational Fields	
OccFld 72	=1 if OccFld=72 (Aviation Command/Control and Anti-Air Warfare); otherwise =0
OccFld 73	=1 if OccFld=73 (Enlisted Flight Crew); otherwise =0
OccFld 99	=1 if OccFld=99 (Training); otherwise =0
Combat Arms	=1 if OccFld=03 08 or 18; otherwise=0
SDA	=1 if BMOS=0911, 8152, 8156, 8411 or 8513; otherwise =0

## D. DATA SUMMARY

### 1. Attritors versus Non-attritors

Summary statistics for the full sample are provided in Table 15, while statistics for attritors are provided in Table 16 and for non-attritors in Table 17. “Success Score” is much higher among non-attritors than it is among attritors. Among enlistees in the total sample (Table 15), the average “Success Score” is 1641.6. Among attritors (Table 16), the average “Success Score” is 1528.2 compared to 1661.1 for those enlistees that serve at least 45 months (Table 17). Females represent 6.6% of the total sample; however, they represent 8.1% of attritors compared to 6.0% of non-attritors. Hispanics represent 7.6% of the total sample. They represent 5.9% of attritors compared to 8.1% of non-attritors. 51.5% of the total sample shipped to MCRD Parris Island. 56.2% of attritors shipped to Parris Island compared to 50.5% of non-attritors. The average enlistee who attrites requires .45 drug waivers, .20 law waivers .14 administrative waivers and .16 medical waivers at accession compared to the average enlistee non-attriter who requires .23 drug waivers .1 law waivers .07 administrative waivers and .09 medical waivers at accession.

Table 15. Summary Statistics-Total Sample (n=204,528)

Variable	N	Mean	Std Dev	Min	Max
<b>Dependent Variables</b>					
Success Score	200346	1641.579	118.0445	676	1974.162
Any attrition	204528	0.162711	0.369103	0	1
<b>Demographic Variables</b>					
female	204528	0.06625	0.248719	0	1
Hispanic entry	204482	0.076026	0.265041	0	1
Hispanic five YOS	204481	0.129235	0.33546	0	1
Black	204482	0.078535	0.269012	0	1
Asian	204482	0.019361	0.137791	0	1
AIAN	204482	0.007155	0.084282	0	1
NHPI	204482	0.00625	0.078809	0	1
Race Declined	204482	0.101848	0.302449	0	1
alien	204528	0.034905	0.183539	0	1
married entry	204528	0.027038	0.162194	0	1
#_ dependents entry	204258	0.030824	0.224689	0	8
married five YOS	171249	0.506829	0.499955	0	1
#_ dependents five	171189	0.754277	0.94918	0	8
<b>Recruit Variables</b>					
Tier 1	204528	0.97395	0.159285	0	1
Tier 2	204528	0.023801	0.15243	0	1
Tier 3	204528	0.001139	0.033733	0	1
AFQT	204528	60.54801	18.63252	9	99
AR+MK	204528	108.2558	11.99944	0	150
IST Upper Body Strength	204528	45.20532	24.83325	0	102
IST Run Time	204373	11.65821	1.644769	0	99.66666
IST Crunches	204374	11.65822	1.644769	0	99.66666
Open Contract	204528	0.067776	0.251361	0	1
MRCD Parris Island	204528	0.514614	0.499788	0	1
Advanced Pay Grade	204528	.2765587	.4472974	0	1
Drug Waiver	204528	0.27033	0.534683	0	9
Law Waiver	204528	0.115637	0.401109	0	9
Unique Waiver	204528	0.080395	0.310284	0	6
Medical Waiver	204528	0.101223	0.343506	0	5
BMI at Contract Date	203504	23.98402	3.345778	0	45.3058
BMI at Ship Date	204517	24.08816	3.246837	0	45.3058
Overweight Contract Date	204528	0.320812	0.46679	0	1
Overweight at Ship Date	204528	0.353805	0.478151	0	1
Obese at Contract Date	204528	0.042923	0.202685	0	1

Variable	N	Mean	Std Dev	Min	Max
<b>Recruit Variables</b>					
Obese at Ship Date	204528	0.022486	0.148258	0	1
<b>Performance Variables</b>					
Ever Deployed	203126	0.789244	0.407846	0	1
Deployed Pct	204528	0.129496	0.113334	0	1
Avg PFT	203554	233.2208	39.88555	0	300
Avg CFT	127909	275.5989	20.937	171	300
Avg Proficiency Service	201858	43.31198	3.115357	1	50
Avg Conduct Service	201858	42.8742	3.956459	1	50
Avg Rifle	201299	292.9973	19.65141	121.52	351.14
Recommend Reenlist	203742	0.75791	0.42835	0	1
Reenlist	171249	0.285701	0.451749	0	1
Reenlist Bonus (\$,000)	34622	29.50152	18.20317	0	90
Weight Control Assign	204528	0.077833	0.267909	0	1
<b>Occupation Variables</b>					
OccFld 2	198676	0.007681	0.087303	0	1
OccFld 3	198676	0.253111	0.434795	0	1
OccFld 4	198676	0.021392	0.144686	0	1
OccFld 5	198676	0.001691	0.04109	0	1
OccFld 6	198676	0.083231	0.276232	0	1
OccFld 8	198676	0.02938	0.168868	0	1
OccFld 11	198676	0.018961	0.136386	0	1
OccFld 13	198676	0.053499	0.225027	0	1
OccFld 18	198676	0.017602	0.131498	0	1
OccFld 21	198676	0.027583	0.163774	0	1
OccFld 23	198676	0.009639	0.097703	0	1
OccFld 26	198676	0.014702	0.120359	0	1
OccFld 28	198676	0.021875	0.146275	0	1
OccFld 30	198676	0.042647	0.202061	0	1
OccFld 31	198676	0.003795	0.061488	0	1
OccFld 33	198676	0.013525	0.115506	0	1
OccFld 34	198676	0.007188	0.084475	0	1
OccFld 35	198676	0.094556	0.292601	0	1
OccFld 43	198676	0.002336	0.04827	0	1
OccFld 44	198676	0.002622	0.051142	0	1
OccFld 46	198676	0.002582	0.050749	0	1
OccFld 55	198676	0.004933	0.07006	0	1
OccFld 57	198676	0.006493	0.080317	0	1
OccFld 58	198676	.02644.	0.16044	0	1

Variable	N	Mean	Std Dev	Min	Max
<b>Occupation Variables</b>					
OccFld 59	198676	0.009991	0.099455	0	1
OccFld 60	198676	0.031816	0.175509	0	1
OccFld 61	198676	.02493	0.155912	0	1
OccFld 62	198676	0.017989	0.132912	0	1
OccFld 63	198676	0.022786	0.149221	0	1
OccFld 64	198676	0.0098	0.098508	0	1
OccFld 65	198676	0.015025	0.12165	0	1
OccFld 66	198676	0.011526	0.10674	0	1
OccFld 68	198676	0.001334	0.036497	0	1
OccFld 70	198676	0.013434	0.115124	0	1
OccFld 72	198676	0.011229	0.105372	0	1
OccFld 73	198676	0.001258	0.035451	0	1
OccFld 99	198676	0.014264	0.118579	0	1
Combat arms	204528	0.344794	0.475302	0	1
SDA	48933	0.040647	0.197474	0	1

Table 16. Summary Statistics for Attritors (separate within 45 months) (n=33,279)

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Dependent Variables</b>					
Success Score	29450	1528.214	142.6011	676	1949.841
<b>Demographic Variables</b>					
female	33279	0.081283	0.273273	0	1
Hispanic entry	33261	0.058717	0.235099	0	1
Hispanic five YOS	33261	0.086798	0.281544	0	1
Black	33261	0.092571	0.289835	0	1
Asian	33261	0.014882	0.121084	0	1
AIAN	33261	0.006825	0.082331	0	1
NHPI	33261	0.005051	0.070892	0	1
race declined	33261	0.089444	0.285388	0	1
alien	33279	0.02434	0.154104	0	1
married entry	33279	0.025121	0.156495	0	1
#_dependents entry	33222	0.028927	0.223348	0	8
<b>Recruit Variables</b>					
Tier 1	33279	0.962228	0.190646	0	1
Tier 2	33279	0.035368	0.18471	0	1
Tier 3	33279	0.001292	0.035923	0	1
AFQT	33279	58.1888	18.11315	21	99
AR+MK	33279	106.3882	11.6922	0	150

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Recruit Variables</b>					
IST Upper Body Strength	33279	43.69786	24.44132	0	102
IST Run Time	33276	68.20603	17.19209	0	100
IST Crunches	33257	11.80679	1.518776	0	90.75
Open Contract	33279	0.085489	0.279613	0	1
MRCD Parris Island	33279	0.562667	0.496065	0	1
Advanced Pay Grade	33279	.2343219	.4235806	0	1
Drug Waiver	33279	0.455362	0.655054	0	8
Law Waiver	33279	0.202019	0.521859	0	9
Unique Waiver	33279	0.139127	0.402149	0	5
Medical Waiver	33279	0.161243	0.421946	0	4
BMI at Contract Date	33074	23.95458	3.414206	0	44.94564
BMI at Ship Date	33277	24.03705	3.313842	0	35.70085
Overweight Contract Date	33279	0.313261	0.463826	0	1
Overweight at Ship Date	33279	0.346074	0.475724	0	1
Obese at Contract Date	33279	0.047838	0.213427	0	1
Obese at Ship Date	33279	0.02428	0.153918	0	1
<b>Performance Variables</b>					
Ever Deployed	31881	0.297795	0.457296	0	1
Deployed Pct	33279	0.046137	0.096749	0	1
Avg PFT	32311	213.4074	65.4597	0	300
Avg CFT	7824	269.6914	25.56677	171	300
Avg Proficiency Service	30641	39.5757	5.412226	1	49
Avg Conduct Service	30641	37.95209	6.983811	1	50
Avg Rifle	30386	284.7035	22.11564	121.52	345.8
Recommend Reenlist	33275	0.045981	0.209446	0	1
Reenlist Bonus (\$,000)	0	0	0	0	0
Weight Control Assign	33279	0.052405	0.222847	0	1
<b>Occupation Variables</b>					
OccFld 2	29051	0.004372	0.065975	0	1
OccFld 3	29051	0.298888	0.457779	0	1
OccFld 4	29051	0.018691	0.135435	0	1
OccFld 5	29051	0.001343	0.036616	0	1
OccFld 6	29051	0.072149	0.258739	0	1
OccFld 8	29051	0.027297	0.16295	0	1
OccFld 11	29051	0.016523	0.127476	0	1
OccFld 13	29051	0.044474	0.206148	0	1
OccFld 18	29051	0.021376	0.144637	0	1
OccFld 21	29051	0.024199	0.153669	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Occupation Variables</b>					
OccFld 23	29051	0.010774	0.10324	0	1
OccFld 26	29051	0.009088	0.094896	0	1
OccFld 28	29051	0.016901	0.128904	0	1
OccFld 30	29051	0.046608	0.210801	0	1
OccFld 31	29051	0.003305	0.057391	0	1
OccFld 33	29051	0.016316	0.12669	0	1
OccFld 34	29051	0.008055	0.089388	0	1
OccFld 35	29051	0.097312	0.296387	0	1
OccFld 43	29051	0.001446	0.037996	0	1
OccFld 44	29051	0.002203	0.046885	0	1
OccFld 46	29051	0.001928	0.043863	0	1
OccFld 55	29051	0.003408	0.058278	0	1
OccFld 57	29051	0.005749	0.075602	0	1
OccFld 58	29051	0.022891	0.149558	0	1
OccFld 59	29051	0.009053	0.094718	0	1
OccFld 60	29051	0.02475	0.155364	0	1
OccFld 61	29051	0.019517	0.138337	0	1
OccFld 62	29051	0.013459	0.115232	0	1
OccFld 63	29051	0.018967	0.13641	0	1
OccFld 64	29051	0.005404	0.073316	0	1
OccFld 65	29051	0.009845	0.098733	0	1
OccFld 66	29051	0.009466	0.096834	0	1
OccFld 68	29051	0.001033	0.032119	0	1
OccFld 70	29051	0.011394	0.106134	0	1
OccFld 72	29051	0.010568	0.102256	0	1
OccFld 73	29051	0.000654	0.025566	0	1
OccFld 99	29051	0.042718	0.202224	0	1
Combat arms	33279	0.337991	0.473033	0	1

Table 17. Summary Statistics for non-Attriters (n=171,249)

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Dependent Variables</b>					
Success Score	170896	1661.115	101.1695	729.02	1974.162
<b>Demographic Variables</b>					
female	171249	0.063329	0.243554	0	1
Hispanic entry	171221	0.079389	0.270345	0	1
Hispanic five YOS	171220	0.137478	0.344352	0	1
Black	171221	0.075809	0.264692	0	1
Asian	171221	0.020231	0.140791	0	1
AIAN	171221	0.007219	0.084656	0	1
NHPI	171221	0.006483	0.080255	0	1
race declined	171221	0.104257	0.305595	0	1
alien	171249	0.036958	0.188659	0	1
married entry	171249	0.02741	0.163277	0	1
#_dependents entry	171036	0.031192	0.224947	0	6
<b>Recruit Variables</b>					
Tier 1	171249	0.976228	0.15234	0	1
Tier 2	171249	0.021553	0.145221	0	1
Tier 3	171249	0.00111	0.033291	0	1
AFQT	171249	61.00648	18.69731	9	99
AR+MK	171249	108.6187	12.02466	0	150
IST Upper Body Strength	171249	45.49826	24.89818	0	102
IST Run Time	171225	69.70195	17.73249	0	100
IST Crunches	171117	11.62935	1.66662	0	99.66666
Open Contract	171249	0.064333	0.245346	0	1
MRCD Parris Island	171249	0.505276	0.499974	0	1
Advanced Pay Grade	171249	.2847666	.4513045	0	1
Drug Waiver	171249	0.234372	0.500112	0	9
Law Waiver	171249	0.09885	0.37081	0	9
Unique Waiver	171249	0.068981	0.287677	0	6
Medical Waiver	171249	0.08956	0.324797	0	5
BMI at Contract Date	170430	23.98973	3.332316	0	45.3058
BMI at Ship Date	171240	24.0981	3.233571	0	45.3058
Overweight Contract Date	171249	0.322279	0.467351	0	1
Overweight at Ship Date	171249	0.355307	0.478608	0	1
Obese at Contract Date	171249	0.041968	0.200517	0	1
Obese at Ship Date	171249	0.022137	0.147131	0	1
<b>Performance Variables</b>					
Ever Deployed	171245	0.880738	0.324097	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Performance Variables</b>					
Deployed Pct	171249	0.145695	0.109128	0	1
Avg PFT	171243	236.9593	31.53554	0	300
Avg CFT	120085	275.9838	20.54054	171	300
Avg Proficiency Service	171217	43.98063	1.804163	1	50
Avg Conduct Service	171217	43.75507	2.148257	1	50
Avg Rifle	170913	294.4718	18.80102	153	351.14
Recommend Reenlist	170467	0.896877	0.30412	0	1
Reenlist Bonus (\$,000)	34616	29.504	18.20241	0	90
Weight Control Assign	171249	0.082774	0.275541	0	1
<b>Occupation Variables</b>					
OccFld 2	169625	0.008248	0.090441	0	1
OccFld 3	169625	0.24527	0.430249	0	1
OccFld 4	169625	0.021854	0.146207	0	1
OccFld 5	169625	0.001751	0.041808	0	1
OccFld 6	169625	0.085129	0.279074	0	1
OccFld 8	169625	0.029736	0.169859	0	1
OccFld 11	169625	0.019378	0.13785	0	1
OccFld 13	169625	0.055045	0.228069	0	1
OccFld 18	169625	0.016955	0.129103	0	1
OccFld 21	169625	0.028162	0.165436	0	1
OccFld 23	169625	0.009444	0.096722	0	1
OccFld 26	169625	0.015664	0.124172	0	1
OccFld 28	169625	0.022727	0.149031	0	1
OccFld 30	169625	0.041969	0.200519	0	1
OccFld 31	169625	0.003879	0.062162	0	1
OccFld 33	169625	0.013046	0.113474	0	1
OccFld 34	169625	0.007039	0.083604	0	1
OccFld 35	169625	0.094084	0.291946	0	1
OccFld 43	169625	0.002488	0.049816	0	1
OccFld 44	169625	0.002694	0.051836	0	1
OccFld 46	169625	0.002694	0.051836	0	1
OccFld 55	169625	0.005194	0.071881	0	1
OccFld 57	169625	0.006621	0.081097	0	1
OccFld 58	169625	0.027048	0.162224	0	1
OccFld 59	169625	0.010152	0.100244	0	1
OccFld 60	169625	0.033026	0.178704	0	1
OccFld 61	169625	0.025857	0.158709	0	1
OccFld 62	169625	0.018765	0.135694	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Occupation Variables</b>					
OccFld 63	169625	0.02344	0.151297	0	1
OccFld 64	169625	0.010553	0.102183	0	1
OccFld 65	169625	0.015912	0.125134	0	1
OccFld 66	169625	0.011879	0.108343	0	1
OccFld 68	169625	0.001385	0.037195	0	1
OccFld 70	169625	0.013783	0.116591	0	1
OccFld 72	169625	0.011343	0.105897	0	1
OccFld 73	169625	0.001362	0.036878	0	1
OccFld 99	169625	0.009391	0.096453	0	1
Combat arms	171249	0.346116	0.475732	0	1

## 2. Reenlistment versus Leaving Service

The average reenlistment rate for the total sample (Table 15) is 28.6%. Table 18 shows summary statistics for Marines who reenlist and Table 19 shows summary statistics for Marines who do not attrite, but separate from active duty at their End of Active Service (EAS) date. Even among enlistees who do not attrite, “Success Scores” differ when comparing enlistees who choose to reenlist with those who choose not to reenlist. Among those Marines who reenlist (Table 18), the mean “Success Score” is 1695.7 compared to 1647.3 for those Marines who do not reenlist (Table 19). 68.2% of Marines who choose to reenlist are married at the five-year mark compared to 43.7% of Marines who separate. 29.7% of Marines who reenlist were “overweight” at their contract date compared to 33.3% of Marines who leave. Marines who reenlist spend 12.2% of their careers deployed compared to 15.5% for Marines who separate. Marines who reenlist have an average PFT score of 244.7 compared to 235.3 for Marines who do not reenlist. Finally, Marines who reenlist have an average proficiency score of 44.5 and an average conduct score of 44.4 compared to average scores of 43.8 and 43.5 for Marines who do not reenlist.

Table 18. Summary Statistics for Reenlistees (n=48,926)

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Dependent Variables</b>					
Success Score	48898	1695.656	96.23058	862.26	1974.162
<b>Demographic Variables</b>					
female	48926	0.070658	0.256255	0	1
Hispanic entry	48924	0.086951	0.281766	0	1
Hispanic five years of service	48923	0.157819	0.364575	0	1
Black	48924	0.108209	0.310647	0	1
Asian	48924	0.017905	0.132609	0	1
AIAN	48924	0.006152	0.078196	0	1
NHPI	48924	0.007931	0.088701	0	1
race declined	48924	0.11847	0.323167	0	1
alien	48926	0.045804	0.209062	0	1
married entry	48926	0.04145	0.199332	0	1
# dependents entry	48844	0.047723	0.278036	0	4
married five YOS	48926	0.682132	0.465653	0	1
# of dependents five YOS	48917	1.140871	1.079211	0	7
<b>Recruit Variables</b>					
Tier 1	48926	0.976352	0.151951	0	1
Tier 2	48926	0.021441	0.144849	0	1
Tier 3	48926	0.000756	0.02749	0	1
AFQT	48926	59.987	18.34767	15	99
AR+MK	48926	108.4612	11.90215	0	148
IST Upper Body Strength	48926	47.51596	24.92329	0	102
IST Run Time	48918	70.33031	17.83401	0	100
IST Crunches	48885	11.53954	1.621595	0	91.33334
Open Contract	48926	0.073049	0.26022	0	1
MRCD Parris Island	48926	0.52884	0.499173	0	1
Advanced Pay Grade	48926	.3128194	.4636462	0	1
Drug Waiver	48926	0.257164	0.517262	0	7
Law Waiver	48926	0.113784	0.398658	0	9
Unique Waiver	48926	0.087418	0.32074	0	5
Medical Waiver	48926	0.086825	0.321315	0	5
BMI at Contract Date	48685	23.72225	3.22112	0	38.59327
BMI at Ship Date	48923	23.85945	3.128724	0	38.59327
Overweight Contract Date	48926	0.296591	0.456759	0	1
Overweight at Ship Date	48926	0.328292	0.469596	0	1
Obese at Contract Date	48926	0.033152	0.179036	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Recruit Variables</b>					
Obese at Ship Date	48926	0.017067	0.129521	0	1
<b>Performance Variables</b>					
Ever Deployed	48926	0.933144	0.249775	0	1
Deployed Pct	48926	0.12163	0.080721	0	1
Avg PFT	48904	244.6811	27.63355	141.1667	300
Avg CFT	47524	277.8122	20.18524	171	300
Avg Proficiency Service	48903	44.49645	1.868073	1	49
Avg Conduct Service	48903	44.3509	2.142545	1	49
Avg Rifle	48898	298.8305	16.1314	187.3	343
Weight Control Assign	48926	.0764215	.2656741	0	1
<b>Occupation Variables</b>					
OccFld 2	48456	0.010277	0.100856	0	1
OccFld 3	48456	0.178306	0.382774	0	1
OccFld 4	48456	0.026395	0.160309	0	1
OccFld 5	48456	0.002208	0.04694	0	1
OccFld 6	48456	0.089194	0.285027	0	1
OccFld 8	48456	0.029676	0.169695	0	1
OccFld 11	48456	0.017893	0.132562	0	1
OccFld 13	48456	0.051985	0.222	0	1
OccFld 18	48456	0.01523	0.122469	0	1
OccFld 21	48456	0.027902	0.164693	0	1
OccFld 23	48456	0.00972	0.098112	0	1
OccFld 26	48456	0.015561	0.123769	0	1
OccFld 28	48456	0.025281	0.156978	0	1
OccFld 30	48456	0.048787	0.215424	0	1
OccFld 31	48456	0.004829	0.069325	0	1
OccFld 33	48456	0.0149	0.121155	0	1
OccFld 34	48456	0.009761	0.098318	0	1
OccFld 35	48456	0.096521	0.295307	0	1
OccFld 43	48456	0.003054	0.055182	0	1
OccFld 44	48456	0.004561	0.067381	0	1
OccFld 46	48456	0.002518	0.050115	0	1
OccFld 55	48456	0.00712	0.084079	0	1
OccFld 57	48456	0.008193	0.090145	0	1
OccFld 58	48456	0.020864	0.142931	0	1
OccFld 59	48456	0.011309	0.105743	0	1
OccFld 60	48456	0.041254	0.198879	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Occupation Variables</b>					
OccFld 61	48456	0.027943	0.164811	0	1
OccFld 62	48456	0.019028	0.136623	0	1
OccFld 63	48456	0.027922	0.164752	0	1
OccFld 64	48456	0.009988	0.099443	0	1
OccFld 65	48456	0.018305	0.134054	0	1
OccFld 66	48456	0.01554	0.123688	0	1
OccFld 68	48456	0.002002	0.044697	0	1
OccFld 70	48456	0.015684	0.124252	0	1
OccFld 72	48456	0.012197	0.109764	0	1
OccFld 73	48456	0.001486	0.038519	0	1
OccFld 99	48456	0.012651	0.111763	0	1
Combat arms	48926	0.275191	0.446615	0	1
SDA	48926	0.040633	0.19744	0	1

Table 19. Summary Statistics for Leavers at EAS (n=122,323)

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Dependent Variables</b>					
Success Score	121998	1647.27	99.78094	729.02	1972.56
<b>Demographic Variables</b>					
female	122323	0.060398	0.238223	0	1
Hispanic entry	122297	0.076363	0.26558	0	1
Hispanic five YOS	122297	0.129341	0.335578	0	1
Black	122297	0.062847	0.242689	0	1
Asian	122297	0.021162	0.143923	0	1
AIAN	122297	0.007645	0.087103	0	1
NHPI	122297	0.005904	0.076609	0	1
race declined	122297	0.098572	0.298087	0	1
alien	122323	0.03342	0.179731	0	1
married entry	122323	0.021795	0.146013	0	1
#_dependents entry	122192	0.024584	0.199437	0	6
married five YOS	122323	0.436713	0.495981	0	1
# of dependents five YOS	122272	0.599614	0.843635	0	8
<b>Recruit Variables</b>					
Tier 1	122323	0.976178	0.152496	0	1
Tier 2	122323	0.021599	0.145369	0	1
Tier 3	122323	0.001251	0.035345	0	1
AFQT	122323	61.41425	18.81996	9	99
AR+MK	122323	108.6818	12.07279	0	150

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Recruit Variables</b>					
IST Upper Body Strength	122323	44.69124	24.84239	0	102
IST Run Time	122307	69.45064	17.68555	0	100
IST Crunches	122232	11.66527	1.682955	0	99.66666
Open Contract	122323	0.060847	0.239051	0	1
MRCD Parris Island	122323	0.495851	0.499985	0	1
Advanced Pay Grade	122323	.2735463	.4457806	0	1
Drug Waiver	122323	0.225256	0.492793	0	9
Law Waiver	122323	0.092877	0.358896	0	8
Unique Waiver	122323	0.061607	0.272988	0	6
Medical Waiver	122323	0.090653	0.326174	0	5
BMI at Contract Date	121745	24.09669	3.369833	0	45.3058
BMI at Ship Date	122317	24.19355	3.269707	0	45.3058
Overweight Contract Date	122323	0.332554	0.47113	0	1
Overweight at Ship Date	122323	0.366113	0.481743	0	1
Obese at Contract Date	122323	0.045494	0.208387	0	1
Obese at Ship Date	122323	0.024166	0.153564	0	1
<b>Performance Variables</b>					
Ever Deployed	122319	0.859777	0.34722	0	1
Deployed Pct	122323	0.15532	0.117226	0	1
Avg PFT	122294	235.282	31.63712	122	300
Avg CFT	72561	274.7863	20.68267	171	300
Avg Proficiency Service	122314	43.77439	1.735593	5	50
Avg Conduct Service	122314	43.51684	2.103842	5	50
Avg Rifle	122016	292.7252	19.49841	153	351.14
Weight Control Assign	122323	.0853151	.2793512	0	1
<b>Occupation Variables</b>					
OccFld 2	121169	0.007436	0.085911	0	1
OccFld 3	121169	0.27205	0.445017	0	1
OccFld 4	121169	0.020038	0.140131	0	1
OccFld 5	121169	0.001568	0.039568	0	1
OccFld 6	121169	0.083503	0.276643	0	1
OccFld 8	121169	0.02976	0.169926	0	1
OccFld 11	121169	0.019972	0.139905	0	1
OccFld 13	121169	0.056269	0.230441	0	1
OccFld 18	121169	0.017645	0.131657	0	1
OccFld 21	121169	0.028266	0.165733	0	1
OccFld 23	121169	0.009334	0.096161	0	1
OccFld 26	121169	0.015705	0.124334	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Occupation Variables</b>					
OccFld 28	121169	0.021705	0.14572	0	1
OccFld 30	121169	0.039243	0.194173	0	1
OccFld 31	121169	0.003499	0.059051	0	1
OccFld 33	121169	0.012305	0.110244	0	1
OccFld 34	121169	0.00595	0.076909	0	1
OccFld 35	121169	0.09311	0.290587	0	1
OccFld 43	121169	0.002261	0.0475	0	1
OccFld 44	121169	0.001948	0.04409	0	1
OccFld 46	121169	0.002765	0.052508	0	1
OccFld 55	121169	0.004424	0.066363	0	1
OccFld 57	121169	0.005992	0.077174	0	1
OccFld 58	121169	0.029521	0.169262	0	1
OccFld 59	121169	0.009689	0.097955	0	1
OccFld 60	121169	0.029735	0.169857	0	1
OccFld 61	121169	0.025023	0.156195	0	1
OccFld 62	121169	0.01866	0.135321	0	1
OccFld 63	121169	0.021648	0.14553	0	1
OccFld 64	121169	0.010778	0.103258	0	1
OccFld 65	121169	0.014954	0.121371	0	1
OccFld 66	121169	0.010415	0.101523	0	1
OccFld 68	121169	0.001139	0.033729	0	1
OccFld 70	121169	0.013023	0.113374	0	1
OccFld 72	121169	0.011001	0.104308	0	1
OccFld 73	121169	0.001312	0.036201	0	1
OccFld 99	121169	0.008088	0.089569	0	1
Combat arms	122323	0.374484	0.483991	0	1

### 3. Descriptive Statistics

Differences in variables of interest between Hispanics and non-Hispanics are shown in Table 20. Addressing the first secondary research question, Hispanics have a mean “Success Score” of 1648.9 compared to 1641.1 for non-Hispanics. In addition, Hispanics are 4 ppt (27.5%) less likely to attrite, 3 ppt (9.9%) more likely to reenlist, 3.8 ppt (8.8%) more likely to promote to E5 and .65 ppt (15.9%) more likely to promote to E6 than non-Hispanics. The t-test of differences in group means is statistically significant at the 1% level of significance.

Notable demographic differences include the following: Hispanics are 9.4 ppts (125.5%) more likely to be a resident alien, 1.1 ppts (35%) more likely to be married at entry and 6.1 ppts (11.5%) more likely to be married at five years in service or separation. These differences are statistically significant at the 1% level of significance

Addressing the third secondary research question, Hispanics are .8 ppts (.8%) more likely than non-Hispanics to enter service with a Tier 1 education credential. The t-test indicates this difference is statistically significant at the 1% level of significance, but the practical difference is small. The .8% difference equates to .5% of a standard deviation. Although the difference between Hispanics and non-Hispanics with regard to education credential at entry is small and favors Hispanics in the Marine Corps, among 18-24 year old adults in the U.S. population Hispanics are 10.8 ppts (13.5%) less likely to have a Tier 1 credential than non-Hispanics (USD(P&R), 2013).

Among recruit factors, the average Hispanic has an AFQT score that is 6 points (10.3%) lower than the average non-Hispanic and an AR+MK score that is 1.3 points (1.2%) lower. This fact helps answer the fourth secondary research question. Although differences in both metrics are significant at the 1% level of significance, the practical significance of the AR+MK difference is much smaller: 10.8% of a standard deviation for AR+MK compared to 32.1% for AFQT. According to Hattiangadi et al. (2004), much of the Hispanic difference in AFQT scores may be attributed to difficulties speaking and comprehending English. The authors claim these difficulties originate from Spanish being the primary language spoken at home. Whereas AFQT is a function of a recruit's Word Knowledge (WK), Paragraph Comprehension (PC), Arithmetic Reasoning (AR) and Math Knowledge (MK) ASVAB subtest scores, AR+MK is a function of the mathematical subtest scores only and therefore less affected by differences in language comprehension (United States Coast Guard, 2014). Using the AR+MK composite in lieu of AFQT may allow services to assess aptitude without subjecting Hispanic recruits to a systematic disadvantage inherent to having a different maternal language.

Addressing the fifth secondary research question, Hispanics are 2.2 ppts (28.5%) more likely to enlist as an "open contract." This difference is statistically significant at the 1 % level of significance.

Addressing the sixth secondary research question, there is no significant difference between percentage of Hispanics and non-Hispanics who enter service with an advanced pay grade.

Addressing the seventh secondary research questions, Hispanics enter service with .0138 (12.6%) fewer legal waivers, .026 (28.4%) more administrative or unique waivers and .0125 (11.7%) more medical waivers. These differences are statistically significant. There is no statistically significant difference between number of drug waivers for Hispanics and non-Hispanics.

Addressing the eighth secondary research question, Hispanics are 4.6 ppts (13.5%) more likely to be overweight at the contract date, 1.7 ppts (33.4%) more likely to be obese at the contract date and 3.1 ppts (33.7%) more likely to be assigned to weight control while enlisted. All three differences are statistically significant. Consistent with Hattiangadi et al. (2004), Hispanics are 20 ppts (48%) less likely to ship to MCRD Parris Island than non-Hispanics. Hattiangadi et al. (2004), assert that recruits who go to MCRD Parris Island have a higher attrition rate than compared to recruits who go to MCRD San Diego. They attribute the difference in attrition rate to the harsher climate conditions of coastal South Carolina (Hattiangadi, 2004).

Addressing the 11th secondary research question, Hispanics are 4.2 ppts (12.8%) less likely to be assigned to combat arms OccFlds than non-Hispanics. At the individual OccFld level, Hispanics are 4.4 ppts (17.4%) less likely to be assigned to the Infantry OccFld, and .6 ppts (20.7%) less likely to be assigned to the Artillery OccFld. These differences are statistically significant. In addition, Hispanics are 1.3 ppts (28.6%) more likely to be assigned a SDA billet MOS than non-Hispanics.

Table 20. Descriptive Statistics Differences

Variable	Hispanic	Non-Hispanic	t-stat
Attrite	0.1256	0.1657	13.0212***
Reenlist	0.313	0.2834	-7.3223***
E5	0.4552	0.4169	-9.2866***
E6	0.0442	0.0377	-4.0446***
Success Score	1648.9	1641.0	-8.0086***
Alien	0.1214	0.0278	-61.6688***
Married entry	0.0373	0.0262	-8.2094***
# of dependents entry	0.0473	0.0295	-13.7135***
Married five YOS	0.5633	0.502	-9.5206***
# of dependents five YOS	0.8774	0.7437	-15.7674***
Tier 1	0.9808	0.9734	-5.6013***
Tier 2	0.0179	0.0243	4.9789***
Tier 3	0.0006	0.0012	2.1552***
AFQT	55.0196	61.0042	38.6343***
AR+MK	107.0561	108.3548	12.9771***
IST Upper Body Strength	42.3623	45.4404	14.8626***
IST Run Time	67.8831	69.5885	11.581***
IST # of crunches	11.7127	11.6536	-4.3069***
Open contract	0.0881	0.0661	-10.4793***
MCRD Parris Island	0.3302	0.5298	48.1482***
Advanced pay grade	0.2768	.2765	-.0721
Drug waiver	0.2748	0.2699	-1.0869
Law waiver	0.1029	0.1167	4.1174***
Unique waiver	0.1044	0.0784	-10.038***
Med waiver	0.1128	0.1003	-4.3541***
BMI contract date	24.3785	23.9516	-15.2637***
BMI ship date	24.4995	24.0543	-16.4435***
Overweight contract date	0.3634	0.3173	-11.8285***
Overweight ship date	0.4043	0.3497	-13.7159***
Obese contract date	0.0587	0.0419	-7.6499***
Obese ship date	0.0296	0.0219	-6.2155***
Ever deployed	0.8118	0.7874	-7.142***
Deployed pct	0.1343	0.1291	-5.4918***
Average PFT	236.809	232.9266	-11.6489***
Average CFT	276.0374	275.564	-2.1151**
Proficiency service	43.4785	43.2988	-6.8879***
Conduct service	43.0336	42.8618	-5.1855***

Variable	Hispanic	Non-Hispanic	t-stat
Average Rifle	291.50	293.12	9.8057***
Recommend reenlist	0.7951	0.7549	-11.2459***
Reenl bonus (\$,000)	27.8182	29.6586	5.3003***
Weight control assign	0.1061	0.0755	-13.7028***
Combat arms	0.306	0.348	10.5936***
SDA	0.0527	0.0395	-4.1509***
*** - Indicates statistical significance at the 1% level			
** - Indicates statistical significance at the 5% level			
* - Indicates statistical significance at the 10% level			

## E. METHODOLOGY

I estimate both multivariate ordinary least squares (OLS) and probit models to assess the effects of the explanatory variables on the dependent variables. I use an OLS linear regression model to estimate the continuous variable “Success Score.” Attrite, Reenlist and Promotion are considered limited dependent variables because the number of possible responses are binary (Wooldridge, 2009). Use of Ordinary Least Squares is not ideal to estimate limited dependent variable models because the range of predicted probabilities can be less than zero or greater than one and the effects of the determinants are assumed to be fixed across the entire range of possible responses. A probit model is a binary response model, as in Equation [8], that addresses these limitations by using the normal cumulative distribution function [G] (shown in Figure 4) to ensure the predicted probability based on the observed set of parameters ( $\beta_0 + \mathbf{x}\beta$ ) falls between zero and one (Wooldridge, 2009).

$$[8] \quad P(y = 1 | x) = G(\beta_0 + \mathbf{x}\beta)$$

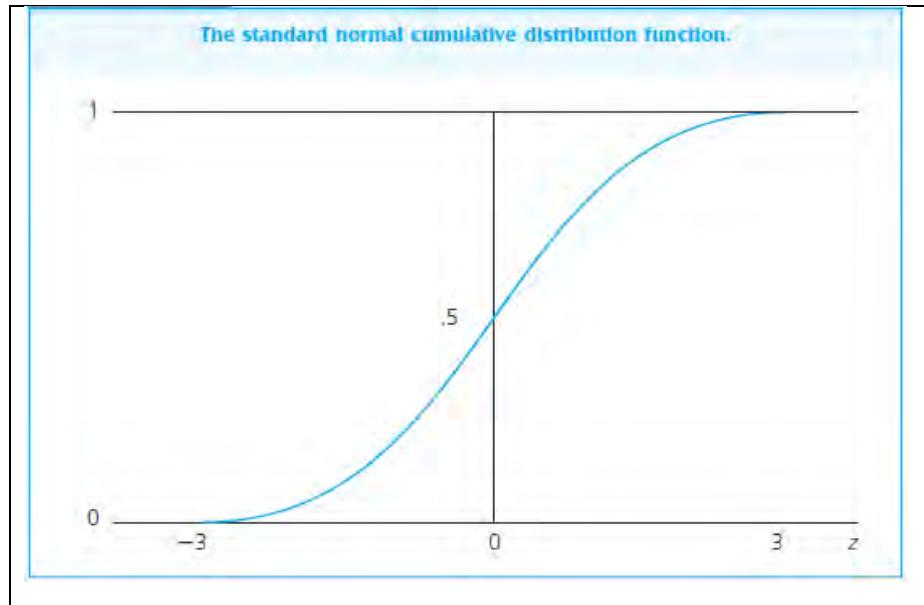


Figure 4. Cumulative Distribution Function [G] (from Wooldridge, 2009)

The probit model is usually a model where the dependent variable is thought to be a function of an unobserved variable or set of variables. This type of function is called a latent variable model (Wooldridge, 2009). In these models, the observed  $Y$  is thought to indicate the presence of the latent  $Y^*$ . The downside of latent variable models is that the latent variable is rarely easy to define or measure (Wooldridge, 2009).  $\beta$ s estimated via latent variable models are not easily interpretable like they are in an ordinary least squares model. Although the direction of  $Y$  and  $Y^*$  are the same, the magnitudes are not. The magnitude of the determinants' effects ( $\beta x_j$ ) on the dependent variable can only be estimated by obtaining the partial derivative of  $p(x)$  with respect to  $x_j$  ( $dp/dx$ ). (Wooldridge, 2009). Stata statistical software does this through the use of the “dprobit” function.

Stata uses maximum likelihood estimation to estimate the probit and “dprobit” models. Maximum likelihood estimation is an iterative process that alters the estimated  $\beta$ s to maximize the probability that the observed values of the independent variables produce the observed outcomes (Wooldridge, 2009).

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## V. MODELS AND RESULTS

### A. EMPIRICAL MODELS

I organize my independent variables into four categories: Demographics, Recruit Characteristics, Performance and Occupation. Each model also controls for entry cohort. Cohort dummies are included to reduce the omitted variable bias that may otherwise occur from unobserved quality differences in recruit pools inherent to changing annual recruiting requirements and economic conditions. The reference (omitted) category in every model is a white, non-Hispanic single male with a Tier 1 education credential and U.S. citizenship who entered service in 2003 as an E1 with either a skill or bonus program (non-open contract) and was assigned the “01” OccFld (Administration). He was neither obese nor overweight when he signed his initial enlistment contract and he did not require any enlistment waivers.

Each outcome variable is estimated first as a function of demographic, recruit and occupational characteristics (Model 1). A second model (Model 2) then adds performance characteristics. Model 1 estimates the likely upper range of the effects of the explanatory variables (especially Hispanic) on the outcomes of interest. While Model 2 controls for individual performance to see how the direct effect of some variables are affected. I use AR+MK scores to measure aptitude in the models in this chapter. Estimations that use AFQT scores rather than AR+MK scores to measure aptitude can be found in Appendix A. A validation of the use of AR+MK in lieu of AFQT can be found in Appendix D.

### B. ATTRITION MODELS

The multivariate attrition models are shown in Figure 5. The models analyze the probability that a recruit leaves service before serving 45 months. Demographic factors include gender, race, ethnicity, citizenship and marital status at entry. Recruit characteristics include cohort, education tier, AR+MK score, IST scores, open contract identifier, advanced paygrade at entry, recruit depot, number of drug waivers, law waivers, unique/administrative waivers or medical waivers and whether the recruit was obese or overweight when he signed his initial enlistment contract. Occupation

characteristics are based on OccFId and performance is based on the “Success Score”. “Success Score” is calculated using performance averages during the Marine’s first term of service. Therefore, average scores for stayers will be based on more observations than for attritors.

Model1 : $\Pr(Attrition = 1   X) = \beta_0 + \beta_1(Demographics) + \beta_2(Recruit) + \beta_3(Occupation) + \mu$
Model 2 : $\Pr(Attrition = 1   X) = \beta_0 + \beta_1(Demographics) + \beta_2(Recruit) + \beta_3(Occupation)$
$+ \beta_4(Performance) + \mu$

Figure 5. Estimated Attrition Models

Partial effects from Probit Attrition Model 1 are shown in Table 21 and partial effects from Probit Attrition Model 2 are shown in Table 22. The full probit coefficients are shown in Appendix B.

Table 21. Attrition Probit Model 1 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	0.0323	0.0039	8.91 ***	0.0659
Hispanic entry	-0.0268	0.0028	-8.81 ***	0.0765
Black	0.0171	0.0031	5.72 ***	0.0788
Asian	-0.0188	0.0055	-3.27 ***	0.0195
AIAN	-0.0194	0.0082	-2.23 **	0.0072
NHPI	-0.0254	0.0090	-2.62 ***	0.0063
race declined	-0.0016	0.0028	-0.57	0.1022
alien	-0.0289	0.0040	-6.65 ***	0.0353
Married Entry	-0.0077	0.0047	-1.62	0.0271
<b>Recruit Factors</b>				
Tier 2	0.0584	0.0058	11.16 ***	0.0235
Tier 3	-0.0117	0.0209	-0.54	0.0011
AR+MK	-0.0011	0.0001	-15.92 ***	108.2690
IST Upper Body Strength	-0.0003	0.0000	-7.65 ***	45.2627
IST Run Time	0.0031	0.0005	6.28 ***	11.6516
IST Crunches	-0.0001	0.0001	-1.90 *	69.5176
Open Contract	0.0122	0.0032	3.87 ***	0.0674
<b>Recruit Factors</b>				

Variable	dF/dx	Std. Err.	z	x-bar
Advanced Pay Grade	-0.0052	0.0018	-2.96 ***	0.2846
MCRD Parris Island	0.0133	0.0017	8.03 ***	0.5143
Drug Waiver	0.0785	0.0014	54.95 ***	0.2674
Law Waiver	0.0424	0.0018	23.76 ***	0.1140
Unique Waiver	0.0537	0.0023	23.40 ***	0.0793
Medical Waiver	0.0584	0.0022	26.89 ***	0.1001
Obese at Contract Date	-0.0168	0.0037	-4.39 ***	0.0429
Overweight Contract Date	-0.0119	0.0018	-6.73 ***	0.3211
Occupation Factors				
OccFld 2	-0.0442	0.0082	-4.66 ***	0.0077
OccFld 3	0.0455	0.0044	10.97 ***	0.2531
OccFld 4	-0.0086	0.0062	-1.35	0.0214
OccFld 5	-0.0076	0.0192	-0.39	0.0017
OccFld 6	-0.0114	0.0043	-2.59 **	0.0832
OccFld 8	0.0006	0.0058	0.11	0.0294
OccFld 11	-0.0180	0.0062	-2.78 ***	0.0190
OccFld 13	-0.0190	0.0046	-3.96 ***	0.0535
OccFld 18	0.0313	0.0076	4.42 ***	0.0176
OccFld 21	-0.0135	0.0056	-2.32 **	0.0276
OccFld 23	0.0301	0.0095	3.38 ***	0.0096
OccFld 26	-0.0211	0.0072	-2.76 ***	0.0147
OccFld 28	-0.0074	0.0064	-1.13	0.0218
OccFld 30	0.0093	0.0053	1.80 *	0.0426
OccFld 31	-0.0340	0.0109	-2.80 ***	0.0038
OccFld 33	0.0091	0.0076	1.22	0.0135
OccFld 34	0.0149	0.0103	1.51	0.0072
OccFld 35	0.0014	0.0044	0.32	0.0946
OccFld 43	-0.0356	0.0148	-2.15 **	0.0023
OccFld 44	-0.0265	0.0138	-1.78 *	0.0026
OccFld 46	-0.0222	0.0146	-1.42	0.0026
OccFld 55	-0.0169	0.0115	-1.40	0.0049
OccFld 57	0.0140	0.0111	1.30	0.0065
OccFld 58	-0.0031	0.0060	-0.51	0.0265
OccFld 59	0.0142	0.0092	1.60	0.0100
Occupation Factors				

Variable	dF/dx	Std. Err.	z	x-bar
OccFld 60	-0.0255	0.0051	-4.67 ***	0.0318
OccFld 61	-0.0220	0.0056	-3.68 ***	0.0249
OccFld 62	-0.0268	0.0062	-4.03 ***	0.0180
OccFld 63	0.0020	0.0065	0.32	0.0228
OccFld 64	-0.0454	0.0073	-5.30 ***	0.0098
OccFld 65	-0.0308	0.0066	-4.28 ***	0.0150
OccFld 66	-0.0305	0.0070	-3.97 ***	0.0115
OccFld 68	-0.0073	0.0215	-0.34	0.0013
OccFld 70	-0.0160	0.0071	-2.16 **	0.0134
OccFld 72	0.0089	0.0085	1.07	0.0112
OccFld 73	-0.0436	0.0199	-1.89 *	0.0013
OccFld 99	0.3528	0.0117	36.56 ***	0.0143
Cohort 2004	0.0002	0.0030	0.06	0.1334
Cohort 2005	0.0012	0.0030	0.42	0.1407
Cohort 2006	-0.0117	0.0029	-3.99 ***	0.1374
Cohort 2007	0.0469	0.0035	14.41 ***	0.1492
Cohort 2008	0.0651	0.0035	20.08 ***	0.1627
Cohort 2009	0.1097	0.0041	30.94 ***	0.1358
observed P(attribe)=0.1462				
predicted P(attribe)=0.1332				
n =198484				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

Table 22. Attrition Model 2 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	0.0287	0.0035	8.89 ***	0.0651
Hispanic entry	-0.0179	0.0025	-6.71 ***	0.0765
Black	0.0083	0.0026	3.23 ***	0.0788
Asian	-0.0129	0.0047	-2.58 **	0.0195
AIAN	-0.0201	0.0066	-2.77 ***	0.0072
NHPI	-0.0127	0.0081	-1.47	0.0063
race declined	0.0013	0.0025	0.54	0.1020
alien	-0.0038	0.0040	-0.94	0.0354
Married Entry	0.0059	0.0044	1.36	0.0270
<b>Recruit Factors</b>				
Tier 2	0.0373	0.0051	8.19 ***	0.0235
Tier 3	-0.0217	0.0155	-1.27	0.0011
AR+MK	0.0002	0.0001	3.87 ***	108.2860
IST Upper Body Strength	0.0013	0.0000	39.15 ***	45.3130
IST Run Time	-0.0057	0.0005	-11.44 ***	11.6482
IST Crunches	0.0001	0.0000	3.27 ***	69.5540
Open Contract	0.0047	0.0027	1.74 *	0.0672
Advanced Pay Grade	0.0002	0.0015	0.11	0.2837
MCRD Parris Island	-0.0066	0.0014	-4.60 ***	0.5139
Drug Waiver	0.0536	0.0012	43.67 ***	0.2660
Law Waiver	0.0355	0.0015	23.05 ***	0.1134
Unique Waiver	0.0379	0.0020	19.18 ***	0.0786
Medical Waiver	0.0345	0.0019	18.43 ***	0.0993
Obese at Contract Date	-0.0336	0.0025	-11.29 ***	0.0429
Overweight Contract Date	-0.0198	0.0015	-13.03 ***	0.3213
<b>Performance Variables</b>				
Success Score	-0.0010	0.0000	-145.95 ***	1644.46
<b>Occupation Variables</b>				
OccFld 2	-0.0383	0.0062	-5.01 ***	0.0077
OccFld 3	0.0211	0.0037	5.94 ***	0.2530
OccFld 4	-0.0194	0.0047	-3.76 ***	0.0215
OccFld 5	-0.0297	0.0134	-1.90 *	0.0017
OccFld 6	-0.0262	0.0032	-7.44 ***	0.0836

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Variables</b>				
OccFld 8	-0.0220	0.0042	-4.78 ***	0.0294
OccFld 11	-0.0177	0.0051	-3.23 ***	0.0190
OccFld 13	-0.0216	0.0036	-5.42 ***	0.0537
OccFld 18	0.0208	0.0065	3.43 ***	0.0177
OccFld 21	-0.0242	0.0042	-5.20 ***	0.0277
OccFld 23	0.0050	0.0073	0.70	0.0097
OccFld 26	-0.0224	0.0056	-3.62 ***	0.0148
OccFld 28	-0.0174	0.0050	-3.24 ***	0.0220
OccFld 30	-0.0076	0.0041	-1.79 *	0.0427
OccFld 31	-0.0217	0.0094	-2.09 **	0.0038
OccFld 33	-0.0345	0.0044	-6.50 ***	0.0135
OccFld 34	0.0206	0.0094	2.34 **	0.0072
OccFld 35	-0.0179	0.0033	-5.03 ***	0.0949
OccFld 43	-0.0266	0.0120	-1.94 *	0.0023
OccFld 44	0.0050	0.0145	0.35	0.0026
OccFld 46	-0.0159	0.0126	-1.18	0.0026
OccFld 55	-0.0274	0.0081	-2.96 ***	0.0049
OccFld 57	0.0135	0.0099	1.43	0.0065
OccFld 58	-0.0091	0.0049	-1.81 *	0.0266
OccFld 59	-0.0016	0.0075	-0.22	0.0100
OccFld 60	-0.0357	0.0036	-8.19 ***	0.0319
OccFld 61	-0.0352	0.0039	-7.56 ***	0.0251
OccFld 62	-0.0392	0.0042	-7.62 ***	0.0181
OccFld 63	-0.0114	0.0051	-2.15 **	0.0229
OccFld 64	-0.0451	0.0051	-6.75 ***	0.0099
OccFld 65	-0.0279	0.0052	-4.69 ***	0.0151
OccFld 66	-0.0321	0.0053	-5.16 ***	0.0116
OccFld 68	-0.0385	0.0128	-2.43 **	0.0013
OccFld 70	-0.0168	0.0058	-2.67 ***	0.0135
OccFld 72	-0.0007	0.0070	-0.09	0.0113
OccFld 73	-0.0368	0.0147	-2.04 **	0.0013
OccFld 99	0.1276	0.0112	14.56 ***	0.0114
Cohort 2004	-0.0072	0.0025	-2.85 ***	0.1330
Cohort 2005	-0.0094	0.0024	-3.81 ***	0.1407

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Variables</b>				
Cohort 2006	-0.0180	0.0023	-7.37 ***	0.1374
Cohort 2007	0.0091	0.0028	3.39 ***	0.1484
Cohort 2008	0.0290	0.0029	10.72 ***	0.1637
Cohort 2009	0.0862	0.0037	27.78 ***	0.1368
observed P(attrite)=0.1393				
predicted P(attrite)=0.0929				
n =196522				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

The mean probability of attrition in Attrition Model 1 (Table 21) is 14.6%. The mean probability of attrition in Attrition Model 2 (Table 22) is 13.9%. In Model 1, seven of nine demographic variables, 13 of 15 recruit variables and 19 of 37 OccFlds have statistically significant effects at the 5% level of significance. “Female”, “Hispanic” and “alien” have the largest estimated effects on attrition of 3.2 ppts (21.9%), -2.7 ppts (-18.5%) and -2.9 ppts (19.9%), respectively. The most practically significant recruit variables are “Tier2” “Drug Waiver” and “Medical Waiver” which have estimated effects of 5.8 ppts (39.7%), 7.9 ppts (54.1%) and 5.8 ppts (39.7%), respectively.

When performance (“Success Score”) is included in Attrition Model 2, two of the demographic variables and one of the recruit variables become insignificant. “Female,” “Hispanic,” “Drug Waiver” and “Medical Waiver” continue to have the largest effects, -2.9 ppts (20.9%), 1.8 ppts (12.9%), -5.4 ppts (38.8%) and -3.5 ppts (25.2%), respectively. “Alien” becomes statistically insignificant. The number of statistically significant OccFlds increases to 27 of 37.

A one standard deviation increase in “Success Score” reduces the estimated probability of attrition by 11.8 ppts (80.8%). One reason that attritors may leave is because they are poor performers or are a bad fit for the military. Including “Success Score” in the model reduces the effect of “Hispanic” from -2.6 to -1.8 points. This

suggests that the coefficient of Hispanic in Model 1 is biased upward due to the positive correlation between Hispanic ethnicity and “Success Score.”

### C. REENLISTMENT MODELS

The reenlistment models (Figure 6) estimate the probability that a Marine reenlists after fulfilling the terms of his initial contract (i.e., he does not leave service within the first 45 months). Demographic factors include gender, race, ethnicity, citizenship and number of dependents at separation or five years of service. Recruit characteristics include cohort, education tier, AR+MK score, IST scores, advanced paygrade at entry, number of drug waivers, number of law waivers, number of unique/administrative number of medical waivers and whether the recruit was obese or overweight when he signed his initial enlistment contract. Waivers are used in the reenlistment models to control for any unobserved individual characteristics that may be captured by a waiver requirement at enlistment. Occupation characteristics are based on OccFld. Performance characteristics include deployed percentage, “Success Score” and weight control assignment indicator. Reenlistment bonus is not used in the model because bonus data was only provided “takers.” Selective Reenlistment Bonuses (SRB) offered to reenlistment-eligible Marines are set annually across MOS by the Marine Corps and are determined by MOS. SRB offers are based on predicted manning shortfalls and also vary with civilian employment conditions. To account for variation in SRB offers across MOS and over time, I use cohort and OccFld dummy variables. I use an “extender” dummy variable to differentiate between Marines who extended for less than 12 months and Marines who reenlisted. I define an “Extender” as someone with a reenlistment date, a separation date within 365 days of the reenlistment date and a non-punitive discharge code. 331 “Extenders” are dropped from the samples used to estimate Reenlistment models.

$$\begin{aligned} \text{Model 1 : } \Pr(\text{Reenlistment} = 1 | X) &= \beta_0 + \beta_1(\text{Demographics}) + \beta_2(\text{Recruit}) + \beta_3(\text{Occupation}) + \mu \\ \text{Model 2 : } \Pr(\text{Reenlistment} = 1 | X) &= \beta_0 + \beta_1(\text{Demographics}) + \beta_2(\text{Recruit}) + \beta_3(\text{Occupation}) \\ &\quad + \beta_4(\text{Performance}) + \mu \end{aligned}$$

Figure 6. Estimated Reenlistment Models

Partial effects of the demographic, recruit and occupation variables in Reenlistment Model 1 are shown in Table 23. The partial effects of the demographic, recruit, occupation and performance variables in Reenlistment Model 2 are shown in Table 24.

Table 23. Reenlistment Model 1 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	0.0052	0.0050	1.05	0.0633
Hispanic entry	0.0063	0.0043	1.48	0.0795
Black	0.0999	0.0047	22.56 ***	0.0761
Asian	0.0015	0.0081	0.19	0.0203
AIAN	-0.0346	0.0126	-2.64 ***	0.0073
NHPI	0.0897	0.0152	6.23 ***	0.0065
race declined	0.0045	0.0038	1.16	0.1045
alien	0.0389	0.0062	6.42 ***	0.0371
# of dependents five YOS	0.1182	0.0012	102.39 ***	0.7535
<b>Recruit Factors</b>				
Tier 2	-0.0014	0.0077	-0.18	0.0216
Tier 3	-0.0841	0.0291	-2.57 **	0.0011
AR+MK	-0.0005	0.0001	-4.7 ***	108.5680
IST Upper Body Strength	0.0007	0.0001	13.84 ***	45.4648
IST Run Time	-0.0093	0.0008	-11.6 ***	11.6299
IST Crunches	0.0004	0.0001	5.09 ***	69.6827
Advanced Pay Grade	0.0340	0.0026	13.42 ***	0.2873
Drug Waiver	-0.0085	0.0024	-3.48 ***	0.2352
Law Waiver	0.0032	0.0031	1.03	0.0990
Unique Waiver	0.0057	0.0039	1.49	0.0693
Medical Waiver	-0.0197	0.0037	-5.35 ***	0.0898
Obese Contract Date	-0.0681	0.0053	-11.83 ***	0.0420
Overweight Contract Date	-0.0249	0.0025	-9.71 ***	0.3221
<b>Occupation Factors</b>				
OccFld 2	0.0244	0.0132	1.89 *	0.0083
OccFld 3	-0.1399	0.0047	-27.24 ***	0.2453
OccFld 4	-0.0061	0.0086	-0.7	0.0219

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Factors</b>				
OccFld 5	0.0263	0.0271	0.99	0.0018
OccFld 6	-0.0534	0.0056	-9.01 ***	0.0851
OccFld 8	-0.0568	0.0072	-7.4 ***	0.0297
OccFld 11	-0.0888	0.0076	-10.43 ***	0.0194
OccFld 13	-0.0797	0.0058	-12.52 ***	0.0550
OccFld 18	-0.0816	0.0082	-8.91 ***	0.0169
OccFld 21	-0.0657	0.0072	-8.5 ***	0.0281
OccFld 23	-0.0519	0.0110	-4.44 ***	0.0094
OccFld 26	-0.0374	0.0094	-3.81 ***	0.0157
OccFld 28	-0.0135	0.0086	-1.54	0.0227
OccFld 30	-0.0375	0.0066	-5.44 ***	0.0419
OccFld 31	-0.0337	0.0166	-1.96 *	0.0039
OccFld 33	-0.0419	0.0097	-4.12 ***	0.0131
OccFld 34	0.0452	0.0144	3.26 ***	0.0071
OccFld 35	-0.0680	0.0054	-11.76 ***	0.0941
OccFld 43	0.0222	0.0226	1	0.0025
OccFld 44	0.0974	0.0233	4.43 ***	0.0027
OccFld 46	-0.0673	0.0186	-3.32 ***	0.0027
OccFld 55	0.0374	0.0165	2.34 **	0.0052
OccFld 57	0.0084	0.0142	0.6	0.0066
OccFld 58	-0.1196	0.0062	-16.01 ***	0.0271
OccFld 59	-0.0300	0.0111	-2.62 ***	0.0102
OccFld 60	-0.0117	0.0075	-1.54	0.0330
OccFld 61	-0.0415	0.0077	-5.15 ***	0.0259
OccFld 62	-0.0688	0.0081	-7.84 ***	0.0188
OccFld 63	-0.0228	0.0082	-2.72 ***	0.0235
OccFld 64	-0.0610	0.0103	-5.49 ***	0.0106
OccFld 65	-0.0170	0.0096	-1.75 *	0.0159
OccFld 66	0.0113	0.0111	1.03	0.0119
OccFld 68	0.0604	0.0309	2.04 **	0.0014
OccFld 70	-0.0333	0.0097	-3.3 ***	0.0138
OccFld 72	-0.0492	0.0102	-4.56 ***	0.0113
OccFld 73	-0.0183	0.0284	-0.63	0.0014
OccFld 99	-0.0162	0.0116	-1.37	0.0094

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Factors</b>				
Cohort 2004	0.0777	0.0045	17.96 ***	0.1343
Cohort 2005	0.0341	0.0043	8.14 ***	0.1414
Cohort 2006	-0.0223	0.0041	-5.4 ***	0.1394
Cohort 2007	-0.0557	0.0040	-13.44 ***	0.1511
Cohort 2008	-0.0873	0.0038	-21.58 ***	0.1624
Cohort 2009	-0.0756	0.0040	-17.74 ***	0.1315
observed P(reenl)=0.2843				
predicted P(reenl)=0.2679				
n =168,796				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

Table 24. Reenlistment Model 2 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	-0.0129	0.0048	-2.67 ***	0.0633
Hispanic entry	-0.0014	0.0043	-0.32	0.0794
Black	0.0984	0.0047	22.04 ***	0.0762
Asian	-0.0110	0.0079	-1.36	0.0203
AIAN	-0.0294	0.0127	-2.24 **	0.0073
NHPI	0.0732	0.0153	5.06 ***	0.0065
race declined	-0.0058	0.0038	-1.53	0.1045
alien	0.0162	0.0061	2.69 ***	0.0370
# of dependents five YOS	0.1124	0.0012	96.96 ***	0.7539
<b>Recruit Factors</b>				
Tier 2	0.0041	0.0078	0.53	0.0216
Tier 3	-0.0632	0.0305	-1.9 *	0.0011
AR+MK	-0.0018	0.0001	-17.8 ***	108.5720
IST Upper Body Strength	-0.0009	0.0001	-15.67 ***	45.4732
IST Run Time	-0.0001	0.0007	-0.15	11.6303
IST Crunches	0.0002	0.0001	3.15 ***	69.6880
Advanced Pay Grade	0.0279	0.0026	10.99 ***	0.2875

Variable	dF/dx	Std. Err.	z	x-bar
<b>Recruit Factors</b>				
Drug Waiver	-0.0045	0.0025	-1.82 *	0.2350
Law Waiver	-0.0035	0.0031	-1.13	0.0990
Unique Waiver	0.0063	0.0039	1.63	0.0692
Medical Waiver	-0.0086	0.0037	-2.33 **	0.0897
Obese Contract Date	-0.0344	0.0058	-5.72 ***	0.0420
Overweight Contract Date	-0.0088	0.0026	-3.4 ***	0.3222
<b>Performance Variables</b>				
Deployed Pct	-0.7029	0.0123	-56.71 ***	0.1457
Success Score	0.0012	0.0000	94.02 ***	1662.00
<b>Occupation Variables</b>				
occ_fld_2	0.1349	0.0152	9.6 ***	0.0083
occ_fld_3	-0.0508	0.0055	-9.03 ***	0.2451
occ_fld_4	0.0697	0.0098	7.46 ***	0.0219
occ_fld_5	0.0666	0.0290	2.42 **	0.0018
occ_fld_6	0.0474	0.0068	7.22 ***	0.0851
occ_fld_8	0.0409	0.0088	4.79 ***	0.0297
occ_fld_11	-0.0399	0.0087	-4.38 ***	0.0194
occ_fld_13	0.0001	0.0070	0.02	0.0550
occ_fld_18	-0.0205	0.0097	-2.08 **	0.0170
occ_fld_21	-0.0064	0.0082	-0.77	0.0281
occ_fld_23	0.0108	0.0127	0.86	0.0094
occ_fld_26	0.0287	0.0107	2.74 ***	0.0157
occ_fld_28	0.0345	0.0094	3.78 ***	0.0228
occ_fld_30	0.0130	0.0074	1.79 *	0.0419
occ_fld_31	-0.0257	0.0169	-1.48	0.0039
occ_fld_33	0.0693	0.0120	6.11 ***	0.0131
occ_fld_34	0.0452	0.0144	3.26 ***	0.0071
occ_fld_35	0.0232	0.0065	3.64 ***	0.0941
occ_fld_43	0.0574	0.0237	2.53 **	0.0025
occ_fld_44	0.0530	0.0223	2.48 **	0.0027
occ_fld_46	-0.0580	0.0190	-2.83 ***	0.0027
occ_fld_55	0.0733	0.0173	4.47 ***	0.0051
occ_fld_57	0.0495	0.0152	3.38 ***	0.0066
occ_fld_58	-0.0946	0.0067	-12.28 ***	0.0271

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Variables</b>				
occ_fld_59	-0.0101	0.0115	-0.87	0.0102
occ_fld_60	0.0387	0.0082	4.9 ***	0.0330
occ_fld_61	0.0380	0.0090	4.36 ***	0.0259
occ_fld_62	-0.0221	0.0090	-2.4 **	0.0188
occ_fld_63	0.0162	0.0088	1.86 *	0.0235
occ_fld_64	-0.0298	0.0110	-2.61 ***	0.0106
occ_fld_65	0.0307	0.0104	3.03 ***	0.0160
occ_fld_66	0.0553	0.0119	4.84 ***	0.0119
occ_fld_68	0.1469	0.0339	4.69 ***	0.0014
occ_fld_70	-0.0094	0.0102	-0.91	0.0138
occ_fld_72	-0.0068	0.0111	-0.6	0.0113
occ_fld_73	0.0857	0.0334	2.73 ***	0.0014
occ_fld_99	0.0148	0.0123	1.22	0.0093
cohort_2004	0.0748	0.0045	17.24 ***	0.1343
cohort_2005	0.0322	0.0043	7.68 ***	0.1416
cohort_2006	-0.0371	0.0040	-9.09 ***	0.1397
cohort_2007	-0.0741	0.0038	-18.16	0.1512
cohort_2008	-0.1135	0.0035	-28.66	0.1626
cohort_2009	-0.1156	0.0036	-28.11	0.1317
observed P(reenl)=0.2848				
predicted P(reenl)=0.2531				
n =168,796				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

The mean probability of reenlistment in Reenlistment Models 1 and 2 (Tables 23 and 24) is 28.5%. In Model 1, five of nine demographic variables, ten of 13 recruit variables and 25 of 37 OccFlds are statistically significant. “Black” and “NHPI” increase the probability of reenlistment by 10 ppts (35.1%) and 9 ppts (31.6%), respectively. The coefficient of “# of dependents five YOS” increases reenlistment by 11.8 ppts (41.4%) for one additional dependent. The recruit variables with the largest practical significance

are “Advanced Pay Grade,” “Obese” and “Overweight” which have estimated effects of 3.4 ppts (11.9%), -6.8 ppts (-23.9%) and -2.5 ppts (-8.7%), respectively.

After controlling for performance in Reenlistment Model 2, six of nine demographic variables, seven of 13 recruit variables and 19 of 37 OccFlds remain statistically significant. “Black,” “NHPI,” “# of Dependents,” “Advanced Pay Grade,” “Obese” and “Overweight” remain statistically significant but the practical significance of each decreases. Both performance variables are statistically and practically significant. A one standard deviation increase in percentage of deployed days decreases the estimated probability of reenlistment by 7.9 ppts (27.7%); however, a one standard deviation increase in “Success Score” increases the estimated probability of reenlistment by 14.6 ppts (51.2%). The large effect of “Success Score” on reenlistment can be attributed to two factors. First, Marines for whom the military is a good fit are more likely to perform well and also are more likely to reenlist. Second, the Marine Corps is more likely to retain Marines who perform well.

#### **D. PROMOTION MODELS**

The promotion models (Figure 7) estimate the probability that a Marine is:

- promoted to E5, conditional on not attriting service within the first 45 months, or
- promoted to E6, conditional on reenlistment.

For both models, demographic factors include gender, race, ethnicity, citizenship and number of dependents at separation or five years of service. Recruit characteristics include cohort, education tier, AR+MK score, IST scores, open contract identifier, advanced paygrade at entry, recruit depot, number of drug waivers, number of law waivers, number of unique/administrative number of medical waivers and whether the recruit was obese or overweight when he signed his initial enlistment contract. Waivers are used in the promotion models to control for any unobserved individual characteristics that may be captured by a waiver requirement at enlistment. Performance characteristics include deployed percentage, weight control assignment and “Success Score”. For the E5 Promotion model, occupation characteristics include OccFld. For E6 Promotion model, occupation characteristics include SDA identifier and OccFld.

$\text{Model 1 : } \Pr(Promotion = 1   X) = \beta_0 + \beta_1(\text{Demographics}) + \beta_2(\text{Recruit}) + \beta_3(\text{Occupation}) + \mu$ $\text{Model 2 : } \Pr(Promotion = 1   X) = \beta_0 + \beta_1(\text{Demographics}) + \beta_2(\text{Recruit}) + \beta_3(\text{Occupation})$ $+ \beta_4(\text{Performance}) + \mu$
---

Figure 7. Estimated Promotion Models

### 1. E5 Promotion

Partial effects for the demographic, recruit and occupation variables in E5 Promotion Model 1 are shown in Table 25. Partial effects for the demographic, recruit, occupation and performance variables in E5 Promotion Model 2 are shown in Table 26.

Table 25. E5 Promotion Model 1 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	-0.0081	0.0058	-1.39	0.0634
Hispanic entry	0.0042	0.0049	0.86	0.0796
Black	0.0037	0.0050	0.74	0.0761
Asian	0.0336	0.0092	3.67 ***	0.0203
AIAN	-0.1023	0.0149	-6.73 ***	0.0073
NHPI	0.0575	0.0159	3.6 ***	0.0065
race declined	0.0063	0.0045	1.4	0.1046
alien	0.0796	0.0068	11.5 ***	0.0371
# of dependents five YOS	0.0796	0.0014	57.45 ***	0.7544
<b>Recruit Factors</b>				
Tier 2	-0.0221	0.0088	-2.51 **	0.0216
Tier 3	-0.1525	0.0377	-3.85 ***	0.0011
AR+MK	0.0044	0.0001	37.84 ***	108.5650
IST Upper Body Strength	0.0025	0.0001	39.6 ***	45.4643
IST Run Time	-0.0200	0.0009	-22.37 ***	11.6298
IST Crunches	0.0003	0.0001	3.85 ***	69.6772
Advanced Pay Grade	0.0905	0.0029	31.16 ***	0.2874
Drug Waiver	-0.0218	0.0028	-7.68 ***	0.2355
Law Waiver	0.0100	0.0036	2.76 ***	0.0992
Unique Waiver	-0.0067	0.0046	-1.46	0.0694
<b>Recruit Factors</b>				

Variable	dF/dx	Std. Err.	z	x-bar
Medical Waiver	-0.0469	0.0042	-11.15 ***	0.0899
Obese Contract Date	-0.1189	0.0066	-17.46 ***	0.0420
Overweight Contract Date	-0.0366	0.0030	-12.4 ***	0.3220
Occupation Factors				
OccFld 2	0.3437	0.0102	24.11 ***	0.0083
OccFld 3	-0.1076	0.0065	-16.43 ***	0.2453
OccFld 4	0.1052	0.0100	10.3 ***	0.0219
OccFld 5	0.1932	0.0278	6.39 ***	0.0018
OccFld 6	0.2297	0.0064	32.56 ***	0.0851
OccFld 8	0.1546	0.0088	16.73 ***	0.0297
OccFld 11	-0.0626	0.0108	-5.77 ***	0.0194
OccFld 13	0.0651	0.0079	8.16 ***	0.0551
OccFld 18	0.1492	0.0106	13.42 ***	0.0170
OccFld 21	0.0586	0.0095	6.13 ***	0.0282
OccFld 23	0.1502	0.0132	10.87 ***	0.0094
OccFld 26	0.2638	0.0098	22.86 ***	0.0157
OccFld 28	0.2108	0.0092	20.85 ***	0.0227
OccFld 30	0.0968	0.0082	11.57 ***	0.0420
OccFld 31	0.1147	0.0201	5.56 ***	0.0039
OccFld 33	0.0822	0.0122	6.65 ***	0.0130
OccFld 34	0.0571	0.0159	3.56 ***	0.0070
OccFld 35	0.0044	0.0073	0.6	0.0941
OccFld 43	0.1401	0.0243	5.53 ***	0.0025
OccFld 44	0.0935	0.0242	3.8 ***	0.0027
OccFld 46	-0.0177	0.0249	-0.71	0.0027
OccFld 55	0.2356	0.0162	12.78 ***	0.0052
OccFld 57	-0.0059	0.0166	-0.35	0.0066
OccFld 58	-0.0179	0.0097	-1.84 *	0.0271
OccFld 59	0.2430	0.0118	17.96 ***	0.0102
OccFld 60	0.1723	0.0084	19.28 ***	0.0330
OccFld 61	0.2037	0.0088	21.27 ***	0.0259
OccFld 62	0.1835	0.0100	17.15 ***	0.0188
OccFld 63	0.2355	0.0088	23.8 ***	0.0234
OccFld 64	0.1830	0.0123	13.8 ***	0.0105
Occupation Factors				

Variable	dF/dx	Std. Err.	z	x-bar
OccFld 65	0.0286	0.0116	2.46 **	0.0159
OccFld 66	0.0770	0.0127	6 ***	0.0119
OccFld 68	0.2136	0.0300	6.41 ***	0.0014
OccFld 70	0.0785	0.0119	6.52 ***	0.0138
OccFld 72	0.2305	0.0114	17.95 ***	0.0113
OccFld 73	0.3176	0.0256	9.38 ***	0.0014
OccFld 99	0.2481	0.0128	16.7 ***	0.0094
Cohort 2004	-0.0070	0.0049	-1.43	0.1344
Cohort 2005	-0.0742	0.0048	-15.47 ***	0.1412
Cohort 2006	-0.0953	0.0048	-19.76 ***	0.1392
Cohort 2007	-0.1439	0.0048	-29.42 ***	0.1509
Cohort 2008	-0.2076	0.0045	-43.4 ***	0.1622
Cohort 2009	-0.2958	0.0043	-60.39 ***	0.1313
observed P(E5)=0.4986				
predicted P(E5)=0.4993				
n =169,437				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

Table 26. E5 Promotion Model 2 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	0.0139	0.0064	2.19 **	0.063333
Hispanic entry	-0.0208	0.0054	-3.83 ***	0.079457
Black	0.0039	0.0055	0.72	0.076187
Asian	0.0149	0.0100	1.49	0.020269
AIAN	-0.1083	0.0161	-6.56 ***	0.007267
NHPI	0.0157	0.0175	0.89	0.006463
race declined	-0.0166	0.0049	-3.39 ***	0.104604
alien	0.0340	0.0076	4.46 ***	0.037068
# of dependents five YOS	0.0887	0.0015	57.89 ***	0.754764
<b>Recruit Variables</b>				

Variable	dF/dx	Std. Err.	z	x-bar
Tier 2	-0.0157	0.0096	-1.63	0.021611
Tier 3	-0.1128	0.0427	-2.57 **	0.001106
AR+MK	0.0022	0.0001	17.44 ***	108.569
IST Upper Body Strength	-0.0016	0.0001	-22.43 ***	45.4726
IST Run Time	0.0003	0.0009	0.33	11.6302
IST Crunches	0.0000	0.0001	0.15	69.6824
Advanced Pay Grade	0.0971	0.0032	30.57 ***	0.287513
Drug Waiver	-0.0216	0.0031	-6.94 ***	0.235332
Law Waiver	-0.0103	0.0040	-2.59 **	0.099111
Unique Waiver	-0.0008	0.0050	-0.15	0.06934
Medical Waiver	-0.0187	0.0047	-4.01 ***	0.089834
Obese Contract Date	-0.0275	0.0078	-3.5 ***	0.041975
Overweight Contract Date	0.0093	0.0033	2.8 ***	0.322174
Performance Variables				
Deployed Pct	-0.1322	0.0144	-9.16 ***	0.145993
Weight Control Assign	-0.0749	0.0057	-12.93 ***	0.082969
Success Score	0.0032	0.0000	168.85 ***	1662.07
Occupation Variables				
OccFld 2	0.4245	0.0072	30.33 ***	0.00826
OccFld 3	-0.0623	0.0074	-8.37 ***	0.24507
OccFld 4	0.1955	0.0101	17.78 ***	0.021872
OccFld 5	0.2727	0.0270	8.39 ***	0.001756
OccFld 6	0.3652	0.0056	50.11 ***	0.085098
OccFld 8	0.2769	0.0081	28.72 ***	0.029712
OccFld 11	-0.0400	0.0121	-3.31 ***	0.019388
OccFld 13	0.1506	0.0084	17.25 ***	0.055061
OccFld 18	0.2361	0.0103	20.18 ***	0.016964
OccFld 21	0.1682	0.0097	16.47 ***	0.028192
OccFld 23	0.2717	0.0119	19.07 ***	0.009419
OccFld 26	0.3626	0.0080	31.19 ***	0.015681
OccFld 28	0.3085	0.0083	29.43 ***	0.022735
OccFld 30	0.1862	0.0084	20.64 ***	0.041946
OccFld 31	0.1685	0.0209	7.57 ***	0.003867
OccFld 33	0.2698	0.0106	21.39 ***	0.013044
Occupation Variables				

Variable	dF/dx	Std. Err.	z	x-bar
OccFld 34	0.0749	0.0172	4.31 ***	0.00706
OccFld 35	0.1212	0.0078	15.18 ***	0.094121
OccFld 43	0.2136	0.0237	8.13 ***	0.002472
OccFld 44	0.0452	0.0271	1.66 *	0.002702
OccFld 46	-0.0221	0.0278	-0.79	0.00269
OccFld 55	0.3619	0.0122	20.08 ***	0.005186
OccFld 57	0.0129	0.0180	0.72	0.006616
OccFld 58	0.0314	0.0107	2.93 ***	0.027087
OccFld 59	0.3154	0.0108	22.42 ***	0.010176
OccFld 60	0.2724	0.0080	29.02 ***	0.033017
OccFld 61	0.3220	0.0076	33 ***	0.025892
OccFld 62	0.3062	0.0087	27.97 ***	0.018797
OccFld 63	0.3262	0.0079	31.79 ***	0.023462
OccFld 64	0.2863	0.0112	20.88 ***	0.010566
OccFld 65	0.0862	0.0124	6.84 ***	0.015947
OccFld 66	0.1529	0.0133	10.97 ***	0.011861
OccFld 68	0.3618	0.0215	11.26 ***	0.00139
OccFld 70	0.1275	0.0126	9.77 ***	0.013777
OccFld 72	0.3114	0.0103	23.51 ***	0.011341
OccFld 73	0.4137	0.0168	13 ***	0.001366
OccFld 99	0.3045	0.0124	19.29 ***	0.009348
Cohort 2004	-0.0082	0.0054	-1.53	0.134352
Cohort 2005	-0.0901	0.0052	-17.24 ***	0.141447
Cohort 2006	-0.1232	0.0051	-23.48 ***	0.1394
Cohort 2007	-0.1679	0.0052	-31.38 ***	0.1509
Cohort 2008	-0.2456	0.0048	-47 ***	0.1624
Cohort 2009	-0.3622	0.0042	-68.88 ***	0.1315
observed P(E5)=0.4989				
predicted P(E5)=0.4983				
n =169,123				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

The mean probability of promotion in E5 Promotion Models 1 and 2 (Tables 25 and 26) is 49.9%. In Model 1, five of nine demographic variables are statistically significant at the 5% level of significance. The demographic variables with the largest practical significance are “AIAN,” “alien” and “# of dependents five YOS” which effect estimated probability of promotion by -10.2 ppts (20.4%), 8 ppts (16%) and 8 ppts (16%), respectively. 12 of 13 recruit variables have effects that are statistically significant. The recruit variables with the largest practical significance are “Advanced Pay Grade,” “Medical Waiver” and “Obese”. These variables affect the estimated probability of E5 promotion by 9.1 ppts (18.2%), -4.7 ppts (-9.4%) and -11.9 ppts (-23.8%) respectively. 34 of 37 OccFlds have effects that are statistically significant.

After controlling for performance in Model 2, effects from six of nine recruit variables remain statistically significant. “AIAN,” “alien” and “# of dependents five YOS” are still the variables with largest practical significance. They effect the estimated probability of promotion by -10.8 ppts (-21.6%), 3.4 ppts (6.8%) and 8.9 ppts (17.8%), respectively. The effect from “Hispanic” becomes negative in Model 2, likely because of omitted variable bias in Model 1. Hispanic is associated with higher rates of promotion and correlated with higher “Success Score”. Thus, if “Success Score” is omitted from performance models, “Hispanic” will have an upward bias.

Nine of 13 recruit variables have effects that are statistically significant in Model 2. “Advanced Pay Grade” “Medical waiver,” and “Obese” have the largest practical significance and which effect the estimated probability of promotion by 9.7 ppts (19.4%), -1.8 ppts (-3.6%) and -2.8 ppts (-5.6%) respectively. Most OccFlds have effects that are statistically significant. All three performance variables have statistically significant effects. A one standard deviation increase in “Deployed Pct” decreases the estimated probability of promotion by 1.5 ppts (3%) and a one standard deviation increase in “Success Score” increases the estimated probability by 37.8 ppts (74.6%). “Weight control assign” decreases the estimated probability of promotion by 7.5 ppts (15%).

## 2. E6 Promotion

Partial effects for the demographic, recruit and occupation variables in E6 Promotion Model 1 are shown in Table 27. Partial effects for the demographic, recruit, occupation and performance variables in E6 Promotion Model 2 are shown in Table 28.

Table 27. E6 Promotion Model 1 Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	0.0093	0.0050	1.97 **	0.070753
Hispanic entry	-0.0052	0.0036	-1.4	0.087031
Black	-0.0194	0.0031	-5.61 ***	0.108618
Asian	-0.0126	0.0069	-1.68 *	0.017972
AIAN	-0.0348	0.0081	-3.05 ***	0.006177
NHPI	0.0151	0.0154	1.06	0.007891
race declined	0.0011	0.0031	0.36	0.118968
alien	0.0044	0.0055	0.83	0.046046
# of dependents five YOS	0.0018	0.0010	1.85 *	1.14151
<b>Recruit Variables</b>				
Tier 2	0.0166	0.0084	2.14 **	0.021443
Tier 3	-0.0276	0.0292	-0.74	0.000764
AR+MK	0.0024	0.0001	25.76 ***	108.408
IST Upper Body Strength	0.0005	0.0000	9.5 ***	47.485
IST Run Time	-0.0052	0.0007	-7.19 ***	11.5399
IST Crunches	0.0001	0.0001	1.02	70.3045
Advanced Pay Grade	0.0227	0.0025	9.71 ***	0.315692
Drug Waiver	0.0023	0.0019	1.2	0.258614
Law Waiver	0.0064	0.0023	2.77 ***	0.114051
Unique Waiver	0.0000	0.0030	0	0.087919
Medical Waiver	-0.0035	0.0030	-1.15	0.087093
Obese Contract Date	-0.0118	0.0054	-2.02 **	0.0333
Overweight Contract Date	-0.0029	0.0024	-1.18	0.296046
<b>Occupation Variables</b>				
SDA	0.2159	0.0105	30.74 ***	0.040778
OccFld 2	0.3305	0.0275	17.55 ***	0.010288

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Variables</b>				
OccFld 3	-0.0158	0.0044	-3.33 ***	0.178256
OccFld 4	0.1385	0.0150	12.95 ***	0.026421
OccFld 5	0.0641	0.0320	2.54 **	0.00221
OccFld 6	0.0308	0.0070	4.98 ***	0.0892
OccFld 8	0.0956	0.0128	9.96 ***	0.029685
OccFld 11	-0.0202	0.0071	-2.44 **	0.01791
OccFld 13	-0.0318	0.0043	-5.76 ***	0.051996
OccFld 18	-0.0029	0.0095	-0.3	0.015245
OccFld 21	0.0047	0.0080	0.61	0.027909
OccFld 23	-0.0348	0.0069	-3.63 ***	0.009709
OccFld 26	0.2413	0.0219	16.14 ***	0.015576
OccFld 28	0.0366	0.0101	4.24 ***	0.025264
OccFld 30	0.0051	0.0066	0.79	0.048794
OccFld 31	-0.0126	0.0152	-0.76	0.004813
OccFld 33	-0.0332	0.0070	-3.5 ***	0.014894
OccFld 34	0.0288	0.0138	2.38 **	0.009771
OccFld 35	-0.0406	0.0036	-8.6 ***	0.096513
OccFld 43	-0.0207	0.0151	-1.16	0.003037
OccFld 44	0.0077	0.0168	0.48	0.004565
OccFld 46	0.0251	0.0270	1.05	0.00252
OccFld 55	0.1300	0.0236	7.69 ***	0.007127
OccFld 57	0.0105	0.0129	0.86	0.00818
OccFld 58	-0.0271	0.0059	-3.68 ***	0.020885
OccFld 59	0.0559	0.0155	4.46 ***	0.01132
OccFld 60	0.0251	0.0080	3.53 ***	0.041192
OccFld 61	0.0576	0.0110	6.51 ***	0.02795
OccFld 62	0.0508	0.0122	5.11 ***	0.019026
OccFld 63	0.0106	0.0079	1.41	0.02795
OccFld 64	-0.0258	0.0081	-2.56 **	0.009998
OccFld 65	-0.0226	0.0067	-2.85 ***	0.018282
OccFld 66	-0.0224	0.0072	-2.63 ***	0.015514
OccFld 68	0.1090	0.0430	3.46 ***	0.002004
OccFld 70	-0.0056	0.0089	-0.61	0.0157
OccFld 72	0.1497	0.0201	10.6 ***	0.012209

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
OccFld 73	0.1020	0.0457	3.02	***	0.001487
OccFld 99	0.0900	0.0150	7.99	***	0.012643
Cohort 2004	-0.0279	0.0023	-10.84	***	0.178958
Cohort 2005	-0.0446	0.0022	-18.07	***	0.16301
Cohort 2006	-0.0482	0.0021	-19.24	***	0.133594
Cohort 2007	-0.0735	0.0022	-30.51	***	0.132974
Cohort 2008	-0.0927	0.0024	-34.78	***	0.128223
Cohort 2009	-0.1058	0.0019	-23.94	***	0.110953
observed P(E6)=0.1330					
predicted P(E6)=0.0631					
n =48,408					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 28. E6 Promotion Model 2 Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	0.0106	0.0041	2.83	***	0.070739
Hispanic entry	-0.0076	0.0025	-2.82	***	0.08704
Black	-0.0160	0.0022	-6.32	***	0.108609
Asian	-0.0143	0.0044	-2.73	***	0.017974
AIAN	-0.0247	0.0055	-3	***	0.006177
NHPI	0.0025	0.0103	0.24		0.007892
race declined	-0.0040	0.0022	-1.78	*	0.11896
alien	-0.0065	0.0035	-1.75	*	0.046051
# of dependents five YOS	0.0030	0.0007	4.03	***	1.14146
<b>Recruit Variables</b>					
Tier 2	0.0120	0.0066	2.02	**	0.021445
Tier 3	-0.0185	0.0235	-0.6		0.000764
AR+MK	0.0015	0.0001	21.02	***	108.409
IST Upper Body Strength	-0.0002	0.0000	-5.21	***	47.4865
IST Run Time	0.0000	0.0005	0.06		11.5398

Variable	dF/dx	Std. Err.	z	x-bar
<b>Recruit Variables</b>				
IST Crunches	0.0000	0.0001	0.48	70.3051
Advanced Pay Grade	0.0176	0.0019	9.84 ***	0.315724
Drug Waiver	0.0008	0.0014	0.55	0.25862
Law Waiver	0.0000	0.0017	0.01	0.114043
Unique Waiver	0.0005	0.0023	0.21	0.087887
Medical Waiver	0.0024	0.0023	1.06	0.087102
Obese Contract Date	0.0057	0.0054	1.11	0.033304
Overweight Contract Date	0.0052	0.0020	2.73 ***	0.296056
<b>Performance Variables</b>				
Deployed Pct	0.0371	0.0105	3.56 ***	0.12184
Weight Control Assign	-0.0377	0.0019	-12.83 ***	0.076648
Success Score	0.0005	0.0000	49.87 ***	1697.58
<b>Occupation Variables</b>				
SDA	0.1300	0.0084	24.57 ***	0.040783
OccFld 2	0.3863	0.0304	19.99 ***	0.010289
OccFld 3	-0.0111	0.0034	-3.01 ***	0.178253
OccFld 4	0.1546	0.0160	15.28 ***	0.026424
OccFld 5	0.0846	0.0328	3.73 ***	0.002211
OccFld 6	0.0621	0.0080	10.38 ***	0.089209
OccFld 8	0.1318	0.0147	13.83 ***	0.029688
OccFld 11	-0.0166	0.0049	-2.76 ***	0.017912
OccFld 13	-0.0178	0.0036	-4.03 ***	0.052001
OccFld 18	0.0162	0.0097	1.91 *	0.015247
OccFld 21	0.0250	0.0083	3.58 ***	0.027911
OccFld 23	-0.0206	0.0056	-2.72 ***	0.00971
OccFld 26	0.2888	0.0242	19.27 ***	0.015578
OccFld 28	0.0522	0.0103	6.73 ***	0.025267
OccFld 30	0.0149	0.0060	2.77 ***	0.048799
OccFld 31	-0.0077	0.0117	-0.6	0.004814
OccFld 33	-0.0019	0.0092	-0.2	0.014875
OccFld 34	0.0339	0.0127	3.32 ***	0.009772
OccFld 35	-0.0190	0.0033	-4.79 ***	0.096502
OccFld 43	-0.0009	0.0156	-0.06	0.003037
OccFld 44	-0.0019	0.0112	-0.17	0.004566

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Variables</b>				
OccFld 46	0.0051	0.0178	0.3	0.002521
OccFld 55	0.2092	0.0292	11.6 ***	0.007128
OccFld 57	0.0126	0.0110	1.27	0.008181
OccFld 58	-0.0181	0.0044	-3.26 ***	0.020887
OccFld 59	0.0624	0.0149	5.75 ***	0.011322
OccFld 60	0.0434	0.0082	6.77 ***	0.041196
OccFld 61	0.0936	0.0127	10.79 ***	0.027953
OccFld 62	0.0825	0.0137	8.66 ***	0.019028
OccFld 63	0.0197	0.0073	3.11 ***	0.027953
OccFld 64	-0.0093	0.0076	-1.11	0.009999
OccFld 65	-0.0076	0.0060	-1.16	0.018284
OccFld 66	-0.0099	0.0062	-1.44	0.015516
OccFld 68	0.1670	0.0514	5.16 ***	0.002004
OccFld 70	0.0019	0.0075	0.26	0.015702
OccFld 72	0.1718	0.0215	12.73 ***	0.01221
OccFld 73	0.1776	0.0560	5.08 ***	0.001488
OccFld 99	0.0850	0.0141	8.78 ***	0.012644
Cohort 2004	-0.0212	0.0017	-11.22 ***	0.178956
Cohort 2005	-0.0352	0.0017	-20.2 ***	0.163027
Cohort 2006	-0.0384	0.0016	-22.36 ***	0.133607
Cohort 2007	-0.0547	0.0019	-33.97 ***	0.132967
Cohort 2008	-0.0681	0.0022	-37.69 ***	0.128236
Cohort 2009	-0.0792	0.0018	-25.12	0.110964
observed P(E6)=0.1330				
predicted P(E6)=0.0408				
n =48,403				
*** - Indicates statistical significance at the 1% level				
** - Indicates statistical significance at the 5% level				
* - Indicates statistical significance at the 10% level				

The mean probability of promotion in E6 Promotion Models 1 and 2 (Tables 27 and 28) is 13.3%. In Model 1, the coefficients of “female,” “Black” and “AIAN” which significantly affect the estimated probability of promotion by +2.3 ppts (17.3%), -5.3 ppts (-39.8%) and -3.5 ppts (-26.3%), respectively. Seven of 13 recruit variables have effects

that are statistically significant. The recruit variables with the largest practical significance are “Tier 2,” “Advanced Pay Grade,” and “Obese,” affecting the probability of promotion by 1.6 ppts (12%), 2.3 ppts (17.3%) and -1.2 ppts (-9%), respectively. 34 of 37 OccFlds have effects that are statistically significant. SDA is an occupation factor with one of the largest practical effects on probability of promotion to E6. It increases the estimated probability of promotion by 21.6 ppts (162.4%) This large effect is likely an effect of SDA Marines being considered “Highly Qualified” by promotion boards.

After controlling for performance in Model 2, six of nine recruit variables have significant effects. “Black,” “Asian” and AIAN” are the variables with largest practical significance in Model 2. They reduce the estimated probability of promotion by 1.6 ppts (12 %), 1.4 ppts (10.5%) and 2.5 ppts (18.8%), respectively. Among recruit variables, “Tier 2,” “Advanced Pay Grade” and “Overweight” are the recruit variables with the largest practical significance which affect the estimated probability of promotion by 1.2 ppts (9%), 1.8 ppts (13.5%) and -.5 ppts (-3.8%) respectively. Even after controlling for performance, “SDA” still increases the probability of E6 promotion by 13.1 ppts (98.5%).

All three performance variables are statistically significant in E6 Promotion Model 2. A one standard deviation increase in “Deployed Pct” increases the estimated probability of promotion by .4 ppts (3%) and a one standard deviation increase in “Success Score” increases the probability by 5.9 ppts (44.4%). “Weight control assign” decreases the promotion rage by 3.8 ppts (28.6%).

## E. SUCCESS SCORE MODELS

The “Success Score” model (Figure 8) is estimated for Marines who remain in service for at least 45 months after accession. “Success Score” is based on averages of component scores during the Marine’s first term of service. Demographic factors include gender, race, ethnicity, citizenship, marital status at entry and number of dependents at separation or five years of service. Recruit characteristics include cohort, education tier, AR+MK score, IST scores, open contract identifier, advanced paygrade at entry, recruit depot, number of drug waivers, number of law waivers, number of unique/administrative number of medical waivers, whether the recruit was obese or overweight when he signed

his initial enlistment contract and OccFld. The purpose of the “Success Score” model is to determine how pre-accession and demographic factors and occupational assignment affect performance. Occupation assignment can affect “Success Score” through OccFld effects on PFT and Rifle Marksmanship scores and Proficiency and Conduct evaluations. For instance, Marines assigned combat arms OccFlds have significantly lower Proficiency and Conduct evaluations and significantly higher marksmanship and PFT scores.

$$\text{"Success Score"} = \beta_0 + \beta_1(\text{Demographics}) + \beta_2(\text{Recruit}) + \beta_3(\text{Occupation}) + \mu$$

Figure 8. Estimated “Success Score” Model

OLS coefficients for Demographic, Recruit and Occupation variables in the “Success Score” model are shown in Table 29.

Table 29. “Success Score” OLS Coefficients for all Stayers

Variable	OLS Coeff	Std. Err.	z
<b>Demographic Variables</b>			
female	-12.1428	1.1382	-10.67***
Hispanic entry	6.6091	0.9091	7.27***
Black	11.2405	0.9584	11.73***
Asian	0.3318	1.6741	0.20
AIAN	-10.4650	2.6975	-3.88***
NHPI	11.5496	2.9400	3.93***
race declined	0.4699	0.8377	0.56
alien	17.8854	1.2669	14.12***
married entry	7.6925	1.5548	4.95***
# of dependents five YOS	2.3324	0.2626	8.88***
<b>Recruit Variables</b>			
Tier 2	-10.8338	1.7015	-6.37***
Tier 3	-27.2228	7.8731	-3.46***
AR+MK	1.1008	0.0225	48.84***
Open Contract	-3.9335	1.0210	-3.85***
Advanced Pay Grade	10.6442	0.5368	19.83***
MRCD Parris Island	-11.6942	0.5020	-23.30***

Variable	OLS Coeff	Std. Err.	z
<b>Recruit Variables</b>			
Drug Waiver	-2.4552	0.5528	-4.44***
Law Waiver	6.3926	0.7063	9.05***
Unique Waiver	-0.1250	0.8862	-0.14
Medical Waiver	-13.8143	0.8325	-16.59***
Obese at Contract Date	-68.4806	1.3030	-52.56***
Overweight Contract Date	-39.4589	0.5324	-74.11***
<b>Occupation Variables</b>			
OccFld 2	-7.2004	2.9332	-2.45**
OccFld 3	-2.1723	1.3015	-1.67*
OccFld 4	-16.3162	2.0844	-7.83***
OccFld 5	-19.1454	6.7641	-2.83***
OccFld 6	-32.8104	1.4354	-22.86***
OccFld 8	-25.1991	1.7961	-14.03***
OccFld 11	-2.9978	2.1620	-1.39
OccFld 13	-11.7679	1.5563	-7.56***
OccFld 18	-11.9674	2.0917	-5.72***
OccFld 21	-24.2788	1.8302	-13.27***
OccFld 23	-26.2467	2.8323	-9.27***
OccFld 26	-21.8607	2.1968	-9.95***
OccFld 28	-23.0910	2.0082	-11.50***
OccFld 30	-17.8969	1.6967	-10.55***
OccFld 31	-7.6461	4.0926	-1.87*
OccFld 33	-58.2034	2.3768	-24.49***
OccFld 34	-0.9995	3.2287	-0.31
OccFld 35	-27.5942	1.4118	-19.54***
OccFld 43	-11.6074	4.4938	-2.58***
OccFld 44	22.4642	4.9073	4.58***
OccFld 46	3.7943	5.1239	0.74
OccFld 55	-45.9395	3.2217	-14.26***
OccFld 57	-4.2917	3.3009	-1.30
OccFld 58	-6.5384	1.8937	-3.45***
OccFld 59	-8.3521	2.6629	-3.14***
OccFld 60	-17.1128	1.7766	-9.63***
OccFld 61	-23.6491	1.8743	-12.62***
OccFld 62	-26.5481	2.1020	-12.63***
OccFld 63	-13.1070	1.9771	-6.63***
OccFld 64	-22.8705	2.6299	-8.70***
OccFld 65	-6.9471	2.2296	-3.12***

Variable	OLS Coeff	Std. Err.	z
<b>Occupation Variables</b>			
OccFld 66	-15.2907	2.5815	-5.92***
OccFld 68	-44.5613	6.5708	-6.78***
OccFld 70	-5.0661	2.4004	-2.11**
OccFld 72	-8.0880	2.4807	-3.26***
OccFld 73	-22.0850	6.0141	-3.67***
OccFld 99	9.2970	2.9112	3.19***
Cohort 2004	4.7933	0.9106	5.26***
Cohort 2005	2.1991	0.8978	2.45**
Cohort 2006	3.9900	0.9017	4.43***
Cohort 2007	-1.7588	0.9287	-1.89*
Cohort 2008	0.2103	0.9065	0.23
Cohort 2009	12.2980	0.9378	13.11***
_cons	1571.052	2.858394	549.63***
*** - Indicates statistical significance at the 1% level			
** - Indicates statistical significance at the 5% level			
* - Indicates statistical significance at the 10% level			

“Success Score” is also modeled as an outcome of interest because of its consistently high practical significance as a determinant in the other outcome models. Eight of ten demographic variables are statistically significant. Hispanics have an estimated “Success Score” 6.6 points higher than for non-Hispanics, and resident aliens have an estimated score that is 17.9 points higher than for citizens. Other demographic variables with large practical effects are “female,” and “NHPI” which have -12.1 pt (-.7%) and 11.5 pt (.7%) effects on the estimated “Success Score,” respectively. Other factors important in determining “Success Score” are “Tier 2,” “AR+MK,” “Advanced Pay Grade,” “Medical Waiver” and BMI. Among recruit variables, “Advanced Pay Grade” and “AR+MK” increase “Success Score.” The Marine Corps uses accession at an advanced paygrade and skill programs as an incentive for applicants who have demonstrated higher levels of initiative, military propensity or cognitive ability. The institutional assumption is that applicants who have shown the initiative to complete Eagle Scouts, JROTC, or other activities listed in Table 4-2 of MCO P1100.72C (Figure 3), or have higher cognitive ability as measured by AR+MK or AFQT, are likely to perform better than applicants who do not have these background attributes. These

estimated effects support the assumption that recruits with these backgrounds tend to be better performers.

Other variables, such as “Tier 2,” “Medical Waiver” and “Obese” have negative effects on “Success Score.” Most of these variables are controlled by DOD mandate or waiver requirement. The assumption is that applicants who have these characteristics have lower performance potential than those without them, so their recruitment should be restricted. The estimated effects from these variables support that assumption as well.

## F. RESULTS

### 1. Demographic Factors

Analysis of demographic factors assists in answering the first two secondary research questions regarding the effect of Hispanic ethnicity and U.S. citizenship on attrition, promotion and reenlistment. Probability of attrition is 2.7 ppts (18.5%) lower for Hispanics than non-Hispanics (Table 21) and it is 2.9 ppts (19.9%) lower for resident aliens than citizens. After controlling for performance, Hispanics have a 1.8 ppts (12.9%) lower probability of attrition than non-Hispanics but being a resident alien becomes statistically insignificant. The fact that Hispanic ethnicity remains statistically and practically significant, even when controlling for aptitude (AR+MK) and performance (“Success Score”), further supports Hatiangadi’s (2004) claim that a latent characteristic exists that is proxied by ethnic background and which affects first term attrition.

In Reenlistment Model 1 (Table 23), the effect of being Hispanic is insignificant but resident aliens are 3.7 ppts (13%) more likely to reenlist than citizens. After controlling for performance (Table 24), however, the effect of being a resident alien decreases by more than 50%. This pattern repeats itself in the promotion models as well. In these models, the “Hispanic Effect” disappears or exerts a negative effect on the outcome of interest and the effect of being a Resident Alien decreases in practical significance or becomes insignificant, altogether. These changes in estimated effects indicate a potential positive “Hispanic” and “Alien” bias when performance is excluded from the models. This positive bias can be explained by a higher “Success Score” being

associated with higher probability of reenlistment and promotion and also with “Hispanic” and “Alien.”

## **2. Recruit Factors**

Analysis of recruit factors assists in answering secondary research questions three through eight. These questions pertain to differences in education credential, ASVAB scores, skill/bonus programs, advanced pay grade at entry, enlistment waivers and body composition by ethnicity and their effect on attrition, promotion and reenlistment.

### **a. *Education Credential***

The largest effect of education credential was in the attrition models. In Attrition Model 1, Marines with a Tier 2 education credential are 5.8 pts (39.7%) more likely to attrite than those with a Tier 1 credential. After controlling for performance, the practical effect of a Tier 2 education credential decreases, but is still practically and statistically significant. This is consistent with Hattiangadi et al., (2004) who found that a Tier 1 credential reduced the probability of attrition by 9.9 pts (31.3%) and also supports the claim by Wenger (2001) and Hattiangadi (2004) that education credential is one of the most important individual factors predicting first term attrition.

### **b. *ASVAB Scores***

In Attrition Model 1 (Table 23), a one standard deviation increase (12 pts) in the AR+MK score decreases attrition by 1.3 pts (8.9%). This effect is similar to the AFQT effect in Attrition Model 1a (Appendix A), where a one standard deviation (18.63 pts) increase in AFQT decreases attrition by 1.3 pts (8.9%). This finding is also consistent with Wenger and Hodari (2004) who found an 18-point increase in AFQT decreases probability of first term attrition by 3.7 pts (13.1%). AR+MK test score remains statistically significant in Model 2, but the magnitude becomes negligible. A possible explanation for the reduced effect size of AR+MK is that the change in estimated attrition explained by change in aptitude in Model 1 is instead captured by differences in performance.

In Reenlistment Model 1 (Table 25), a one standard deviation increase in the AR+MK score reduces reenlistment by .6 ppts (2.1%). After controlling for performance, the magnitude of the AR+MK effect increases nearly four-fold to -2.2 ppts (-7.5%). This is consistent with Arias' finding that an 18-point increase in AFQT score decreases estimated probability of reenlistment by 9.9% (2006).

In the baseline Promotion models (Tables 27 and 29) a one standard deviation increase in AR+MK score increases promotion to E5 by 5.2 ppts (10.4%) and to E6 by 2.9 ppts (21.8%). After controlling for performance (Tables 28 and 30) the effect of AR+MK on E5 promotion decreases by nearly 50%, to 2.6 ppts (5.3%) and E6 promotion by 40%, to 1.8 ppts (13.5%). This pattern continues to highlight potential omitted variable bias in the baseline models exposed by the addition of performance variables. "Success Score" is associated with higher cognitive ability and higher reenlistment and promotion rates, and one would expect an upward bias on AR+MK in all models.

*c. Skill and Bonus Programs*

After controlling for performance, enlisting as an "open contract" increases attrition by .47 ppts (3.3%). The addition of the "Success Score" variable identifies an upward bias to the coefficient of "open contract" in the attrition model. This upward bias is expected because higher "Success Scores" are correlated with lower probability of enlisting as an open contract and lower attrition rates.

*d. Advanced Pay Grade*

Entering service at an advanced pay grade is one of the most significant determinants of reenlistment and promotion. In the performance models "Advanced Pay Grade" increased reenlistment by 3.4 ppts (11.9%), E5 promotion by 9.7 ppts (19.4%) and E6 promotion by 1.8 ppts (13.5%).

*e. Waivers*

The coefficients of Drug Use Waivers and Medical/Physical waivers tend to have higher levels of practical and statistical significance than those of Law Violation or Administrative/Unique waivers in all models. After controlling for performance, "Drug

Waiver” increases attrition by 5.4 ppts (40.3%) decreases reenlistment by .5 ppts (1.8%) and decreases promotion to E5 by 2.2 ppts (4.4%). “Medical Waiver” increases the probability of attrition by 3.5 ppts (25.1%) and decreases both the probabilities of reenlistment by .9 ppts (3.2%) and E5 promotion by 1.9 ppts (3.8%). No waiver variables are significant in the E6 Promotion model. As expected, the addition of performance variables identifies an upward bias of waivers in the attrition models and a downward bias of waivers in the reenlistment and E5 promotion models.

*f. Body Composition*

In Attrition Model 1, recruits who are “obese” at enlistment are 1.7ppts (11.6%) less likely to attrite and recruits who are “overweight” at enlistment are 1.2 ppts (8.2%) less likely to attrite than the reference Marine. After controlling for “Success Score,” the effects of “obese” (3.4 ppts or 25.4%) and “overweight” (2 ppts or 15%) roughly double. This contradicts Buddin (1989) who found that increased BMI among Army and Marine Corps recruits is related to higher early attrition. This difference could be explained by the current policy that requires recruits’ weights to be less than 105% of the Marine Corps retention standard given their height (Retention standard is equal to a BMI of approximately 27.5) and pass the initial strength test before shipping to boot camp (Headquarters Marine Corps, 2004). A waiver to this policy requires a male recruit to have less than 18% body fat and requires approval from the Region Commanding General (Headquarters Marine Corps, 2004). “Overweight” or “obese” recruits who can change their behavior while in DEP to meet these stringent requirements may possess an unobservable characteristic such as “determination” that reduces their attrition rates.

**3. Occupation Factors**

Analysis of OccFld assists in answering secondary research question 11 regarding the effect of OccFld distribution on the variables of interest. 25% of Marines are assigned to “Infantry” and 34% are assigned to “Combat Arms.” In the performance models, Infantry Marines are 2.1 ppts (15.1%) more likely to attrite than Administration Marines, 5.1 ppts (17.9%) less likely to reenlist, 6.2 ppts (12.4%) less likely to promote to E5 and 1.1 ppts (8.3%) less likely to promote to E6. Marines assigned to “Artillery” are 2.2 ppts

(15.8%) less likely to attrite, 4.1 ppts (14.4%) more likely to reenlist, 27.7 ppts (55.4%) more likely to promote to E5 and 13.2% (46.3%) more likely to promote to E6. Marines assigned to “Tank and AAV” are 2.1 ppts (15.1%) more likely to attrite, 2.1 ppts (7.3%) less likely to reenlist and 23.6 ppts (47.2%) more likely to promote to E5.

The General Technical (GT) and Mechanical Maintenance (MM) composite scores are used to assess applicant qualification for technical skill incentive programs (HQMC, 2012). For the combat arms OccFlds, the mean is 107.8. More technical OccFlds, such as the aviation maintenance OccFlds (60-66) have GT and MM minimums of 105 and higher. The mean for these OccFlds is 112.1. OccFlds 60 (Aircraft Maintenance), 63 (Organizational Avionics Maintenance) and 65 (Aviation Ordnance) are three of the largest aviation maintenance OccFlds and represent the three main functional areas of aircraft maintenance (i.e., powerplant and airframe maintenance, avionics and ordnance/ordnance delivery systems) (HQMC, 2013).

In the performance models, Aircraft Maintenance Marines are 3.6 ppts (25.9%) less likely to attrite than Administration Marines, 3.9 ppts (13.7%) more likely to reenlist, 27.2 ppts (54.4%) more likely to promote to E5 and 4.3 ppts (15.1%) more likely to promote to E6. Organizational Avionics Marines are 1.1 ppts (7.9%) less likely to attrite than Administration Marines, 32.6 ppts (65.2%) more likely to promote to E5 and 2 ppts (15%) more likely to promote to E6. Ordnance Marines are 2.8 ppts (20.1%) less likely to attrite than Administration Marines, 3.1 ppts (10.5%) more likely to reenlist and 8.6 ppts (17.2%) more likely to promote to E5. In general, the aviation maintenance OccFlds are less likely to attrite and more likely to reenlist and promote than the combat arms OccFlds.

Most Marines apply for and are selected for Special Duty Assignments near the end of their first or during their second term of service. All Marines in my model who are selected for an SDA reenlist and 91% of Marines who reenlist are selected for E5. Thus, the E6 Promotion models are the only models with enough variation between SDA and the outcome of interest to provide useful information. In the baseline model, Marines with an SDA are 21.6 ppts (162.4%) more likely to promote to E6 and 13 ppts (97.7%) more likely to promote in the performance model. The difference in the two effects

indicates a positive SDA bias in the baseline model, as expected. Promotion to E6 is *the* major career milestone in an enlisted Marine's career. The High Year Tenure for an E6 is 20 years, making a Marine promoted to E6 retirement-eligible, conditional on further successful reenlistments (HQMC, 2012a). The practical significance of an SDA in predicting promotion to E6, in both the baseline and performance models, further indicates that SDA can be considered a key billet assignment.

#### **4. Performance Factors**

Analysis of performance factors assists in answering secondary research questions nine and ten regarding the effect of deployment and overall performance of the variables of interest. "Deployed percentage" was omitted from Attrition Model 2 because of the potential for reverse causality. Marines who attrite early may never have the opportunity to deploy. Furthermore, Marines who are being processed for legal or administrative separation may be restricted from deploying due to the legal or administrative requirements inherent in the attrition process. In the remaining performance models, a one standard deviation increase in "Deployed percentage" (11.3%) decreases the probability of reenlistment by 7.4 ppts (25.9%), decreases promotion to E5 by 1.6 ppts (3.2%) and increases the probability of promotion to E6 by .4 ppts (3.1%). One third of Marines who do not reenlist successfully promote to E5 compared to 91% of Marines who reenlist. Since a strong relationship exists between reenlistment and promotion to E5, the negative effect of deployment on promotion to E5 may be attributable to the reduced opportunity for promotion caused by a Marine leaving service at the end of his initial obligation. When a Marine reenlists, he indicates a suitable person-job fit with the military. The positive effect of "Deployed percentage" on E6 promotion may indicate that higher performing Marines are marginally more willing to deploy than lower performing Marines, or the institution expects higher performing Marines to spend more time deployed.

In every model, "Success Score" is the most practically significant determinant on the outcome of interest. A one standard deviation increase in "Success Score" (118 points) decreases the probability of attrition by 12.7 ppts (91.4%) and increases the

probability of reenlistment by 15.3 ppts (53.5%), promotion to E5 by 35.4 ppts (72.4%) and promotion to E6 by 5.9 ppts (44.4%). The large effects of “Success Score” on the outcomes of interest further highlight the importance of performance in institutional and individual decision-making.

## **VI. CONCLUSIONS AND RECOMMENDATIONS**

### **A. CONCLUSIONS**

This thesis analyzes the effect of Hispanic ethnicity on first term attrition, reenlistment, promotion to E5 and promotion to E6. The thesis also analyzes an individual's overall performance as measured by "Success Score," a success metric proposed and tested by the author. Hatiangadi et al., (2004) hypothesize that there is a "Hispanic" effect on career outcomes, but that it may simply capture an unobserved trait or group of traits that effect performance of this demographic group in the Marine Corps. The results in this thesis support the existence of a "Hispanic" effect during the first term of service. Even after controlling for observable characteristics, Hispanics are more likely to complete their initial term of obligated service than non-Hispanics. If an unobservable trait exists among Hispanics, and this trait is associated with improved first-term performance, its effect disappears after the initial term of service. When simply comparing mean probabilities, Hispanics are more likely to reenlist and be promoted to E5 and E6. However, after controlling for observable characteristics, the "Hispanic" effect becomes insignificant or negative.

This pattern repeats itself for Marines with a Tier 2 education credential. Even after controlling for observable characteristics, "Tier 2" Marines are more likely to attrite than Marines with a Tier 1 credential. In the reenlistment and E5 promotion models that control for performance, Tier 2 is insignificant. In the E6 promotion model Tier 2 has a significant, but counterintuitive positive effect. However, this pattern makes sense if one believes that pre-accession factors are less important to career outcomes than a Marine's performance during his career.

This thesis uses a new measure of success, "Success Score," proposed and tested in this thesis, to measure a Marine's first-term job performance. Instead of being limited to analysis of the factors that affect a binary performance outcome, estimating a continuous variable like "Success Score" provides a more granular analysis of the factors that affect performance. The analysis of "Success Score" is also important because it is

based on Marine Corps doctrine. This performance variable can then be used to control for a Marine's job performance when estimating traditional binary outcomes such as attrition, promotion and reenlistment. In most other research, a servicemember's actual military performance is not observed when analyzing these career outcomes, especially for enlistees. In every model in this thesis that controls for performance, "Success Score" is the most practically and statistically significant variable, reinforcing the importance of controlling for job performance when estimating the probability of other, more standard, career outcomes. For example, reenlistment and promotion rates at different levels of "Success Score" are shown in Figure 8.

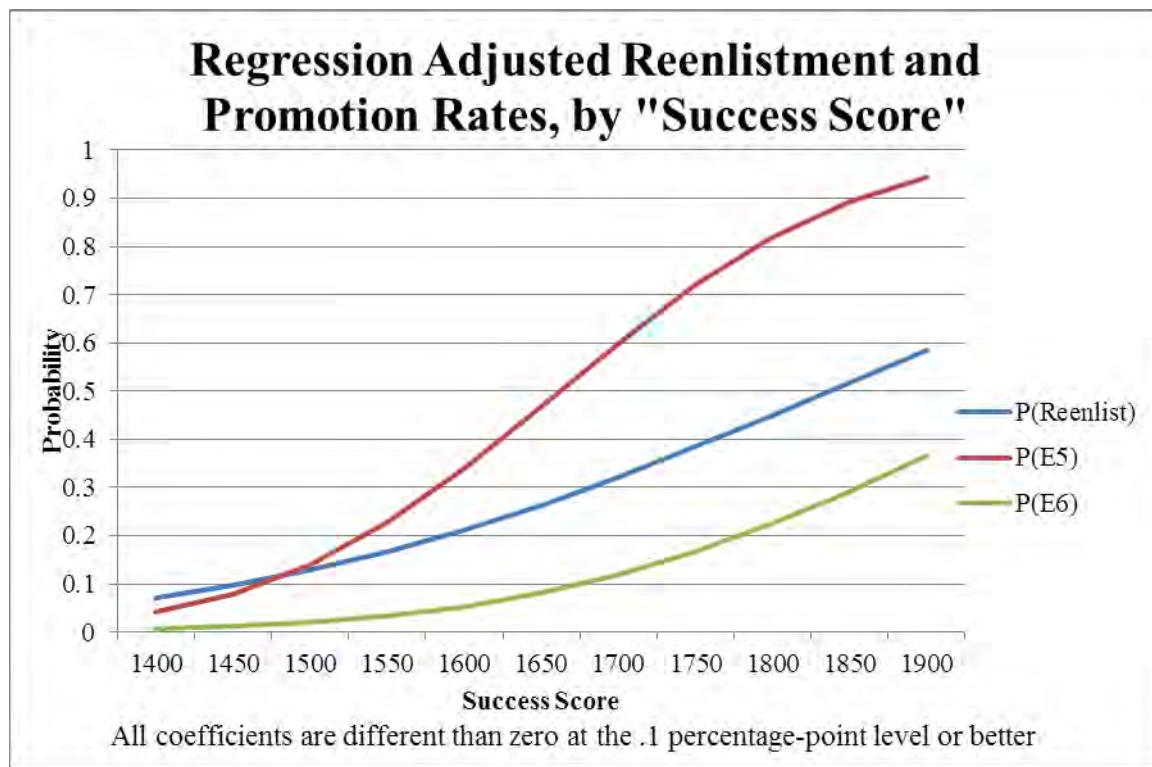


Figure 9. Regression Adjusted Reenlistment and Promotion Rates, by "Success Score"

Although Hispanic ethnicity, citizenship and education credential have limited practical or statistical significance outside of estimating attrition, they indirectly influence reenlistment and promotion via their effect on the "Success Score" performance measure. The standard deviation for "Success Score" is 118 points. The average score for a non-

attriter who is promoted to E5 is 89.5 points higher than a non-attriter who is not promoted to E5. Hispanic ethnicity raises the estimated “Success Score” by 6.6 points, and being a resident alien at enlistment increases it by 17.9 points.

Not only is a higher “Success Score” related to improved attrition, reenlistment and promotion outcomes, but increasing the Marine Corps’ overall “Success Score” is a desirable end in itself. The Marine Corps would likely consider an NCO corps with better performance evaluations, and higher fitness and better marksmanship scores to be more effective than a corps with lower scores. Other factors that influence “Success Score” include accessing as an “open contract,” accessing at an advanced pay grade, enlisting with a drug or medical waiver, BMI and aptitude. Not only do these factors influence “Success Score,” they are also key factors in predicting the other performance outcomes. Although Hispanics have higher “Success Scores” than non-Hispanics, they are more likely to enter service as an “open contract,” less likely to access at an advanced pay grade, more likely to enlist with a drug or medical waiver, more likely to have a higher BMI at enlistment and more likely to have lower ASVAB scores when compared to non-Hispanics. All of these relative traits relate negatively to performance outcomes. Any changes to policy designed to reduce the enlisted force representation gap between Hispanics in the Marine Corps and Hispanics in the overall U.S. population must address these potential obstacles to the career performance of Hispanic recruits.

## B. RECOMMENDATIONS

In 2013, 73.5% of Marine Corps non-prior service accessions scored in the 50th or higher on the AFQT compared to the DOD minimum of 60% (USD(P&R), 2014), and .09% scored in between the tenth and 30th percentile compared to the DOD maximum of 4% (USD(P&R), 2014). If the number of Marines in the AR+MK percentile groups is similar to the number of Marines in the AFQT percentile groups in the total sample, 7.8% of the sample (15,898 observations) had AFQT scores below the 50th percentile (Category 3B or lower) but AR+MK scores at or above the 50th percentile (Category 3A or higher). Of these 15,898 observations, 13.9% (2,160 observations) were Hispanic compared to 7.6% of the total sample. I predict “Success Scores” for Marines that have

Traditional Category 3A and Marines who are in the “Low AFQT/High AR+MK” category based on the “Success Score” estimation explained in Chapter IV, but with a Dummy Variable representing Marines in this unique AFQT mental category. When “Success Scores” are compared, the average “Low AFQT/High AR+MK” Marine has a higher “Success Score” than the average Marine with a traditional Category 3A AFQT score, holding all else constant (Table 30 and Table 40, Appendix A).

Table 30. Regression Adjusted “Success Scores” for Traditional and Trial 3A applicants by AFQT Mental Category

AFQT Mental Category	Traditional 3A	Low AFQT 3A
Cat I	1679.40	N/A
Cat II	1669.52	N/A
Cat IIIA	1660.36	N/A
Cat IIIB	1647.75	1663.81
Cat IV	1646.13	1662.18
All coefficients are different than zero at the .1 percentage-point level or better		

The first recommendation is to create a trial group that treats applicants that fall into the “Low AFQT/High AR+MK” category as if they had a Category 3A AFQT score. Applying this recommendation would enlarge the qualified pool of applicants and increase Hispanic representation in the qualified pool of applicants without degrading the overall quality of the pool or altering DOD procurement standards.

The second recommendation is to more strictly enforce body composition standards and reduce the number of approvals of “Drug Involvement” and “Medical/Physical” waivers, especially in the trial group. If the overall pool of qualified applicants is larger, MCRC could be more selective when assessing factors that are associated with improved first-term outcomes and performance. Decreasing the average BMI of enlisted accessions and reducing the number of enlistees with a history of drug use or medical or physical problems, would improve the overall quality of enlisted accessions.

The third recommendation is to conduct further quantitative research into the use of AR+MK in conjunction with AFQT to assess cognitive aptitude. The first study should be a comparison of AR+MK scores and AFQT scores across all races and ethnicities for all applicants to determine if the relationships identified between test scores for enlisted accessions apply to all applicants. Further research should also be conducted, based on the trial group proposed above. A comparison of early attrition between the trial and control groups could be done within 24 months.

The fourth and final recommendation is to conduct further research on the impact of ethnicity on selection for Special Duty Assignment. This thesis had a limited observation period of only 8 years. Even with the limited observation period, the analysis indicates that SDA selection is a significant determinant of E6 promotion. A more complete analysis could be conducted on the factors associated with selection for SDA and the effect of SDA selection on career outcomes, such as promotion to E7, if the observation period was extended to 12 or more years.

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## APPENDIX A. ADDITIONAL REGRESSION RESULTS

Table 31. Attrition Model 1a (AFQT) Partial Effects

Any attrition	dF/dx	Std. Err.	z	x-bar
female	0.0325	0.0039	8.97	0.0659
Hispanic entry	-0.0286	0.0028	-9.41	0.0765
Black	0.0165	0.0031	5.52	0.0788
Asian	-0.0223	0.0054	-3.91	0.0195
AIAN	-0.0212	0.0082	-2.44	0.0072
NHPI	-0.0273	0.0089	-2.83	0.0063
race declined	-0.0020	0.0028	-0.70	0.1022
alien	-0.0319	0.0039	-7.39	0.0353
Married Entry	-0.0063	0.0047	-1.32	0.0271
Tier 2	0.0614	0.0059	11.65	0.0235
Tier 3	-0.0107	0.0211	-0.49	0.0011
AFQT	-0.0007	0.0000	-14.29	60.5429
IST Upper Body Strength	-0.0003	0.0000	-8.00	45.2627
IST Run Time	0.0032	0.0005	6.55	11.6516
IST Crunches	-0.0001	0.0001	-2.05	69.5176
Open Contract	0.0124	0.0032	3.95	0.0674
Advanced Pay Grade	-0.0051	0.0018	-2.86	0.2846
MRCD Parris Island	0.0136	0.0017	8.21	0.5143
Drug Waiver	0.0785	0.0014	54.97	0.2674
Law Waiver	0.0427	0.0018	23.91	0.1140
Unique Waiver	0.0537	0.0023	23.36	0.0793
Medical Waiver	0.0588	0.0022	27.05	0.1001
Obese at Contract Date	-0.0165	0.0037	-4.28	0.0429
Overweight Contract Date	-0.0118	0.0018	-6.66	0.3211
OccFld 2	-0.0431	0.0082	-4.52	0.0077
OccFld 3	0.0472	0.0044	11.35	0.2531
OccFld 4	-0.0077	0.0062	-1.21	0.0214
OccFld 5	-0.0066	0.0193	-0.34	0.0017
OccFld 6	-0.0119	0.0043	-2.70	0.0832
OccFld 8	0.0017	0.0059	0.29	0.0294
OccFld 11	-0.0184	0.0061	-2.85	0.0190
OccFld 13	-0.0190	0.0046	-3.98	0.0535
OccFld 18	0.0324	0.0076	4.57	0.0176
OccFld 21	-0.0132	0.0056	-2.28	0.0276
OccFld 23	0.0313	0.0095	3.51	0.0096

Any attrition	dF/dx	Std. Err.	z	x-bar
OccFld 26	-0.0205	0.0072	-2.68	0.0147
OccFld 28	-0.0075	0.0064	-1.14	0.0218
OccFld 30	0.0091	0.0053	1.77	0.0426
OccFld 31	-0.0341	0.0109	-2.81	0.0038
OccFld 33	0.0090	0.0076	1.21	0.0135
OccFld 34	0.0160	0.0103	1.61	0.0072
OccFld 35	0.0011	0.0044	0.26	0.0946
OccFld 43	-0.0332	0.0150	-1.99	0.0023
OccFld 44	-0.0257	0.0139	-1.72	0.0026
OccFld 46	-0.0202	0.0148	-1.28	0.0026
OccFld 55	-0.0167	0.0115	-1.38	0.0049
OccFld 57	0.0156	0.0112	1.45	0.0065
OccFld 58	-0.0019	0.0060	-0.31	0.0265
OccFld 59	0.0139	0.0092	1.56	0.0100
OccFld 60	-0.0254	0.0051	-4.65	0.0318
OccFld 61	-0.0218	0.0056	-3.64	0.0249
OccFld 62	-0.0269	0.0062	-4.04	0.0180
OccFld 63	0.0014	0.0064	0.21	0.0228
OccFld 64	-0.0461	0.0073	-5.40	0.0098
OccFld 65	-0.0298	0.0066	-4.13	0.0150
OccFld 66	-0.0306	0.0070	-3.98	0.0115
OccFld 68	-0.0061	0.0216	-0.28	0.0013
OccFld 70	-0.0158	0.0071	-2.12	0.0134
OccFld 72	0.0100	0.0086	1.20	0.0112
OccFld 73	-0.0434	0.0199	-1.88	0.0013
OccFld 99	0.3543	0.0117	36.67	0.0143
Cohort 2004	-0.0001	0.0030	-0.04	0.1334
Cohort 2005	0.0014	0.0030	0.47	0.1407
Cohort 2006	-0.0115	0.0029	-3.92	0.1374
Cohort 2007	0.0472	0.0035	14.50	0.1492
Cohort 2008	0.0655	0.0035	20.18	0.1627
Cohort 2009	0.1107	0.0041	31.17	0.1358
observed P(attrite)=0.1462				
predicted P(attrite)=0.1333				
n=198484				

Table 32. Attrition Model 2a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z	x-bar
<b>Demographic Variables</b>				
female	0.0287	0.0035	8.8900	0.065138
Hispanic entry	-0.0177	0.0025	-6.6200	0.076465
Black	0.0081	0.0027	3.1500	0.078765
Asian	-0.0122	0.0048	-2.4300	0.019494
AIAN	-0.0199	0.0066	-2.7500	0.007236
NHPI	-0.0124	0.0082	-1.4400	0.006279
race declined	0.0014	0.0025	0.5500	0.102014
alien	-0.0032	0.0040	-0.8000	0.03535
Married Entry	0.0056	0.0044	1.2900	0.027005
<b>Recruit Variables</b>				
Tier 2	0.0369	0.0051	8.1	0.0235
Tier 3	-0.0218	0.0154	-1.27	0.0011
AFQT	0.0001	0.0000	2.49	60.5644
IST Upper Body Strength	0.0013	0.0000	39.12	45.3130
IST Run Time	-0.0057	0.0005	-11.51	11.6482
IST Crunches	0.0001	0.0000	3.34	69.5540
Open Contract	0.0043	0.0027	1.62	0.0672
Advanced Pay Grade	0.0003	0.0015	0.17	0.2837
MRCD Parris Island	-0.0066	0.0014	-4.62	0.5139
Drug Waiver	0.0536	0.0012	43.68	0.2660
Law Waiver	0.0355	0.0015	23.05	0.1134
Unique Waiver	0.0377	0.0020	19.04	0.0786
Medical Waiver	0.0345	0.0019	18.41	0.0993
Obese at Contract Date	-0.0336	0.0025	-11.31	0.0429
Overweight Contract Date	-0.0198	0.0015	-13.03	0.3213
<b>Performance Variables</b>				
Success Score	-0.00103	0.0000	-146.06	1644.4600
<b>Occupation Variables</b>				
OccFld 2	-0.0383	0.0062	-5	0.0077
OccFld 3	0.0208	0.0037	5.85	0.2530
OccFld 4	-0.0194	0.0047	-3.77	0.0215
OccFld 5	-0.0292	0.0135	-1.87	0.0017
OccFld 6	-0.0261	0.0032	-7.4	0.0836
OccFld 8	-0.0222	0.0042	-4.81	0.0294
OccFld 11	-0.0176	0.0051	-3.22	0.0190
OccFld 13	-0.0216	0.0036	-5.44	0.0537

Variable	dF/dx	Std. Err.	z	x-bar
<b>Occupation Variables</b>				
OccFld 18	0.0205	0.0065	3.38	0.0177
OccFld 21	-0.0242	0.0042	-5.2	0.0277
OccFld 23	0.0050	0.0073	0.69	0.0097
OccFld 26	-0.0216	0.0056	-3.48	0.0148
OccFld 28	-0.0166	0.0050	-3.09	0.0220
OccFld 30	-0.0076	0.0041	-1.78	0.0427
OccFld 31	-0.0221	0.0093	-2.13	0.0038
OccFld 33	-0.0347	0.0044	-6.54	0.0135
OccFld 34	0.0211	0.0095	2.39	0.0072
OccFld 35	-0.0181	0.0033	-5.09	0.0949
OccFld 43	-0.0265	0.0120	-1.93	0.0023
OccFld 44	0.0050	0.0145	0.35	0.0026
OccFld 46	-0.0160	0.0125	-1.19	0.0026
OccFld 55	-0.0270	0.0081	-2.91	0.0049
OccFld 57	0.0139	0.0099	1.48	0.0065
OccFld 58	-0.0092	0.0049	-1.82	0.0266
OccFld 59	-0.0010	0.0075	-0.13	0.0100
OccFld 60	-0.0356	0.0037	-8.15	0.0319
OccFld 61	-0.0351	0.0039	-7.51	0.0251
OccFld 62	-0.0390	0.0042	-7.58	0.0181
OccFld 63	-0.0109	0.0051	-2.06	0.0229
OccFld 64	-0.0446	0.0051	-6.67	0.0099
OccFld 65	-0.0278	0.0052	-4.66	0.0151
OccFld 66	-0.0319	0.0053	-5.1	0.0116
OccFld 68	-0.0384	0.0128	-2.42	0.0013
OccFld 70	-0.0167	0.0058	-2.65	0.0135
OccFld 72	-0.0006	0.0070	-0.09	0.0113
OccFld 73	-0.0363	0.0148	-2	0.0013
OccFld 99	0.1280	0.0112	14.59	0.0114
Cohort 2004	-0.0071	0.0025	-2.82	0.1330
Cohort 2005	-0.0094	0.0024	-3.82	0.1407
Cohort 2006	-0.0180	0.0023	-7.39	0.1374
Cohort 2007	0.0090	0.0027	3.35	0.1484
Cohort 2008	0.0289	0.0029	10.68	0.1637
Cohort 2009	0.0859	0.0037	27.72	0.1368
observed P(attribe)=0.1393				
predicted P(attribe)=0.0929				
n = 196522				

Table 33. Reenlistment Model 1a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	0.0051	0.0050	1.02		0.0633
Hispanic entry	0.0033	0.0043	0.78		0.0795
Black	0.0959	0.0047	21.67 ***		0.0761
Asian	-0.0006	0.0081	-0.07		0.0203
AIAN	-0.0379	0.0125	-2.91 ***		0.0073
NHPI	0.0866	0.0152	6.03 ***		0.0065
race declined	0.0037	0.0038	0.96		0.1045
alien	0.0358	0.0062	5.91 ***		0.0371
# of dependents five YOS	0.1176	0.0012	101.8 ***		0.7535
<b>Recruit Factors</b>					
Tier 2	0.0010	0.0077	0.13		0.0216
Tier 3	-0.0827	0.0292	-2.53 **		0.0011
AFQT	-0.0007	0.0001	-10.64 ***		60.9102
IST Upper Body Strength	0.0007	0.0001	13.61 ***		45.4648
IST Run Time	-0.0093	0.0008	-11.64 ***		11.6299
IST Crunches	0.0004	0.0001	5.25 ***		69.6827
Advanced Pay Grade	0.0356	0.0026	14.04 ***		0.2873
Drug Waiver	-0.0086	0.0024	-3.5 ***		0.2352
Law Waiver	0.0040	0.0031	1.3		0.0990
Unique Waiver	0.0030	0.0039	0.79		0.0693
Medical Waiver	-0.0193	0.0037	-5.25 ***		0.0898
Obese Contract Date	-0.0680	0.0053	-11.8 ***		0.0420
Overweight Contract Date	-0.0248	0.0025	-9.68 ***		0.3221
<b>Occupation Factors</b>					
OccFld 2	0.0290	0.0133	2.24 **		0.0083
OccFld 3	-0.1393	0.0047	-27.11 ***		0.2453
OccFld 4	-0.0046	0.0087	-0.53		0.0219
OccFld 5	0.0347	0.0274	1.3		0.0018
OccFld 6	-0.0533	0.0056	-9 ***		0.0851
OccFld 8	-0.0556	0.0072	-7.24 ***		0.0297
OccFld 11	-0.0897	0.0075	-10.55 ***		0.0194
OccFld 13	-0.0802	0.0058	-12.61 ***		0.0550
OccFld 18	-0.0824	0.0082	-9.03 ***		0.0169

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Factors</b>					
OccFld 21	-0.0652	0.0072	-8.43	***	0.0281
OccFld 23	-0.0499	0.0111	-4.25	***	0.0094
OccFld 26	-0.0268	0.0097	-2.69	***	0.0157
OccFld 28	-0.0052	0.0088	-0.59		0.0227
OccFld 30	-0.0380	0.0066	-5.53	***	0.0419
OccFld 31	-0.0386	0.0164	-2.26	**	0.0039
OccFld 33	-0.0463	0.0096	-4.57	***	0.0131
OccFld 34	0.0534	0.0146	3.81	***	0.0071
OccFld 35	-0.0713	0.0054	-12.37	***	0.0941
OccFld 43	0.0319	0.0230	1.42		0.0025
OccFld 44	0.1009	0.0234	4.58	***	0.0027
OccFld 46	-0.0632	0.0189	-3.1	***	0.0027
OccFld 55	0.0436	0.0166	2.71	***	0.0052
OccFld 57	0.0174	0.0145	1.22		0.0066
OccFld 58	-0.1178	0.0063	-15.71	***	0.0271
OccFld 59	-0.0245	0.0112	-2.13	**	0.0102
OccFld 60	-0.0091	0.0075	-1.2		0.0330
OccFld 61	-0.0388	0.0078	-4.8	***	0.0259
OccFld 62	-0.0667	0.0081	-7.58	***	0.0188
OccFld 63	-0.0194	0.0083	-2.3	**	0.0235
OccFld 64	-0.0568	0.0104	-5.09	***	0.0106
OccFld 65	-0.0127	0.0097	-1.29		0.0159
OccFld 66	0.0146	0.0111	1.33		0.0119
OccFld 68	0.0665	0.0312	2.24	**	0.0014
OccFld 70	-0.0315	0.0098	-3.12	***	0.0138
OccFld 72	-0.0456	0.0103	-4.21	***	0.0113
OccFld 73	-0.0103	0.0289	-0.35		0.0014
OccFld 99	-0.0108	0.0117	-0.91		0.0094
Cohort 2004	0.0778	0.0045	17.97	***	0.1343
Cohort 2005	0.0341	0.0043	8.14	***	0.1414
Cohort 2006	-0.0223	0.0041	-5.4	***	0.1394
Cohort 2007	-0.0563	0.0040	-13.58	***	0.1511
Cohort 2008	-0.0879	0.0037	-21.76	***	0.1624
Cohort 2009	-0.0756	0.0040	-17.77	***	0.1315

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Factors</b>					
observed P(attrite)=0.2843					
predicted P(attrite)=0.2677					
n =168,796					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 34. Reenlistment Model 2a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	-0.0129	0.0048	-2.66 ***		0.0633
Hispanic entry	-0.0066	0.0042	-1.54		0.0794
Black	0.0944	0.0047	21.15 ***		0.0762
Asian	-0.0178	0.0078	-2.23 **		0.0203
AIAN	-0.0347	0.0125	-2.66 ***		0.0073
NHPI	0.0675	0.0152	4.68 ***		0.0065
race declined	-0.0071	0.0038	-1.86 *		0.1045
alien	0.0093	0.0060	1.56		0.0370
# of dependents five YOS	0.1117	0.0012	96.29 ***		0.7539
<b>Recruit Factors</b>					
Tier 2	0.0099	0.0079	1.26		0.0216
Tier 3	-0.0608	0.0307	-1.83 *		0.0011
AFQT	-0.0015	0.0001	-21.68 ***		60.9170
IST Upper Body Strength	-0.0009	0.0001	-16.05 ***		45.4732
IST Run Time	0.0000	0.0007	0.04		11.6303
IST Crunches	0.0002	0.0001	3.18 ***		69.6880
Advanced Pay Grade	0.0296	0.0026	11.64 ***		0.2875
Drug Waiver	-0.0044	0.0025	-1.78 *		0.2350
Law Waiver	-0.0022	0.0031	-0.71		0.0990
Unique Waiver	0.0039	0.0039	1.02		0.0692
Medical Waiver	-0.0079	0.0037	-2.15 **		0.0897
Obese Contract Date	-0.0337	0.0058	-5.59 ***		0.0420

Variable	dF/dx	Std. Err.	z		x-bar
<b>Recruit Factors</b>					
Overweight Contract Date	-0.0085	0.0026	-3.31 ***		0.3222
<b>Performance Variables</b>					
Deployed Pct	-0.7060	0.0123	-56.94 ***		0.1457
Success Score	0.0012	0.0000	94.21 ***		1662.00
<b>Occupation Variables</b>					
OccFld 2	0.1425	0.0153	10.09 ***		0.0083
OccFld 3	-0.0476	0.0055	-8.45 ***		0.2451
OccFld 4	0.0730	0.0099	7.79 ***		0.0219
OccFld 5	0.0754	0.0293	2.72 ***		0.0018
OccFld 6	0.0476	0.0068	7.25 ***		0.0851
OccFld 8	0.0443	0.0089	5.17 ***		0.0297
OccFld 11	-0.0408	0.0087	-4.49 ***		0.0194
OccFld 13	0.0001	0.0070	0.01		0.0550
OccFld 18	-0.0196	0.0097	-1.99 **		0.0170
OccFld 21	-0.0049	0.0082	-0.59		0.0281
OccFld 23	0.0146	0.0128	1.16		0.0094
OccFld 26	0.0409	0.0110	3.85 ***		0.0157
OccFld 28	0.0430	0.0096	4.66 ***		0.0228
OccFld 30	0.0126	0.0073	1.73 *		0.0419
OccFld 31	-0.0299	0.0167	-1.73 *		0.0039
OccFld 33	0.0646	0.0119	5.71 ***		0.0131
OccFld 34	0.0539	0.0146	3.85 ***		0.0071
OccFld 35	0.0197	0.0065	3.11 ***		0.0941
OccFld 43	0.0710	0.0242	3.10 ***		0.0025
OccFld 44	0.0578	0.0225	2.69 ***		0.0027
OccFld 46	-0.0512	0.0194	-2.47 **		0.0027
OccFld 55	0.0796	0.0175	4.83 ***		0.0051
OccFld 57	0.0609	0.0155	4.12 ***		0.0066
OccFld 58	-0.0911	0.0068	-11.77 ***		0.0271
OccFld 59	-0.0049	0.0117	-0.42		0.0102
OccFld 60	0.0418	0.0082	5.27 ***		0.0330
OccFld 61	0.0418	0.0090	4.79 ***		0.0259
OccFld 62	-0.0197	0.0090	-2.13 **		0.0188
OccFld 63	0.0188	0.0089	2.16 **		0.0235

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
OccFld 64	-0.0266	0.0111	-2.33	**	0.0106
OccFld 65	0.0368	0.0105	3.60	***	0.0160
OccFld 66	0.0590	0.0120	5.15	***	0.0119
OccFld 68	0.1547	0.0341	4.91	***	0.0014
OccFld 70	-0.0068	0.0103	-0.66		0.0138
OccFld 72	-0.0017	0.0113	-0.15		0.0113
OccFld 73	0.0950	0.0337	3.01	***	0.0014
OccFld 99	0.0213	0.0124	1.75	*	0.0093
Cohort 2004	0.0744	0.0045	17.16	***	0.1343
Cohort 2005	0.0322	0.0043	7.68	***	0.1416
Cohort 2006	-0.0369	0.0040	-9.05	***	0.1397
Cohort 2007	-0.0743	0.0038	-18.21	***	0.1512
Cohort 2008	-0.1138	0.0035	-28.77	***	0.1626
Cohort 2009	-0.1150	0.0036	-27.97	***	0.1317
observed P(attribe)=0.2848					
predicted P(attribe)=0.2529					
n=168,796					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 35. E5 Promotion Model 1a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	-0.0089	0.0058	-1.54		0.0634
Hispanic entry	0.0118	0.0050	2.38	**	0.0796
Black	0.0042	0.0050	0.83		0.0761
Asian	0.0498	0.0091	5.44	***	0.0203
AIAN	-0.0956	0.0149	-6.27	***	0.0073
NHPI	0.0655	0.0158	4.11	***	0.0065
race declined	0.0080	0.0045	1.79	*	0.1046
alien	0.0922	0.0068	13.35	***	0.0371
# of dependents five YOS	0.0799	0.0014	57.62	***	0.7544

Variable	dF/dx	Std. Err.	z		x-bar
<b>Recruit Factors</b>					
Tier 2	-0.0324	0.0088	-3.67	***	0.0216
Tier 3	-0.1569	0.0375	-3.96	***	0.0011
AFQT	0.0025	0.0001	32.63	***	60.9067
IST Upper Body Strength	0.0025	0.0001	40.2	***	45.4643
IST Run Time	-0.0205	0.0009	-23	***	11.6298
IST Crunches	0.0004	0.0001	4.23	***	69.6772
Advanced Pay Grade	0.0902	0.0029	31.03	***	0.2874
Drug Waiver	-0.0222	0.0028	-7.8	***	0.2355
Law Waiver	0.0086	0.0036	2.38	**	0.0992
Unique Waiver	-0.0077	0.0046	-1.68	*	0.0694
Medical Waiver	-0.0481	0.0042	-11.44	***	0.0899
Obese Contract Date	-0.1208	0.0066	-17.76	***	0.0420
Overweight Contract Date	-0.0371	0.0030	-12.56	***	0.3220
<b>Occupation Factors</b>					
OccFld 2	0.3397	0.0104	23.73	***	0.0083
OccFld 3	-0.1141	0.0065	-17.45	***	0.2453
OccFld 4	0.1012	0.0100	9.91	***	0.0219
OccFld 5	0.1926	0.0278	6.38	***	0.0018
OccFld 6	0.2300	0.0064	32.63	***	0.0851
OccFld 8	0.1493	0.0088	16.15	***	0.0297
OccFld 11	-0.0618	0.0108	-5.7	***	0.0194
OccFld 13	0.0643	0.0079	8.07	***	0.0551
OccFld 18	0.1440	0.0107	12.94	***	0.0170
OccFld 21	0.0560	0.0095	5.86	***	0.0282
OccFld 23	0.1459	0.0132	10.55	***	0.0094
OccFld 26	0.2625	0.0098	22.68	***	0.0157
OccFld 28	0.2114	0.0092	20.89	***	0.0227
OccFld 30	0.0968	0.0082	11.58	***	0.0420
OccFld 31	0.1127	0.0201	5.47	***	0.0039
OccFld 33	0.0814	0.0122	6.59	***	0.0130
OccFld 34	0.0549	0.0159	3.43	***	0.0070
OccFld 35	0.0040	0.0073	0.55		0.0941
OccFld 43	0.1306	0.0245	5.13	***	0.0025
OccFld 44	0.0901	0.0242	3.66	***	0.0027

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Factors</b>					
OccFld 46	-0.0272	0.0249	-1.09		0.0027
OccFld 55	0.2349	0.0162	12.75 ***		0.0052
OccFld 57	-0.0111	0.0166	-0.67		0.0066
OccFld 58	-0.0236	0.0097	-2.42 **		0.0271
OccFld 59	0.2440	0.0118	18.04 ***		0.0102
OccFld 60	0.1714	0.0084	19.19 ***		0.0330
OccFld 61	0.2018	0.0088	21.06 ***		0.0259
OccFld 62	0.1831	0.0100	17.12 ***		0.0188
OccFld 63	0.2376	0.0087	24.06 ***		0.0234
OccFld 64	0.1865	0.0123	14.09 ***		0.0105
OccFld 65	0.0247	0.0116	2.13 **		0.0159
OccFld 66	0.0769	0.0127	5.99 ***		0.0119
OccFld 68	0.2101	0.0301	6.31 ***		0.0014
OccFld 70	0.0763	0.0119	6.34 ***		0.0138
OccFld 72	0.2267	0.0114	17.62 ***		0.0113
OccFld 73	0.3181	0.0256	9.39 ***		0.0014
OccFld 99	0.2456	0.0129	16.52 ***		0.0094
Cohort 2004	-0.0058	0.0049	-1.18		0.1344
Cohort 2005	-0.0742	0.0048	-15.49 ***		0.1412
Cohort 2006	-0.0960	0.0048	-19.93 ***		0.1392
Cohort 2007	-0.1452	0.0047	-29.73 ***		0.1509
Cohort 2008	-0.2087	0.0045	-43.69 ***		0.1622
Cohort 2009	-0.2980	0.0043	-60.97 ***		0.1313
observed P(attribe)=0.4986					
predicted P(attribe)=0.4993					
n =169,437					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 36. E5 Promotion Model 2a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	0.0137	0.0064	2.15 **		0.063333
Hispanic entry	-0.0160	0.0054	-2.95 ***		0.079457
Black	0.0057	0.0055	1.04		0.076187
Asian	0.0234	0.0100	2.34 **		0.020269
AIAN	-0.1037	0.0162	-6.27 ***		0.007267
NHPI	0.0207	0.0175	1.18		0.006463
race declined	-0.0155	0.0049	-3.16 ***		0.104604
alien	0.0410	0.0076	5.38 ***		0.037068
# of dependents five YOS	0.0892	0.0015	58.11 ***		0.754764
<b>Recruit Variables</b>					
Tier 2	-0.0214	0.0096	-2.22 **		0.021611
Tier 3	-0.1148	0.0427	-2.61 ***		0.001106
AFQT	0.0015	0.0001	17.39 ***		60.9135
IST Upper Body Strength	-0.0016	0.0001	-22.24 ***		45.4726
IST Run Time	0.0001	0.0009	0.15		11.6302
IST Crunches	0.0000	0.0001	0.24		69.6824
Advanced Pay Grade	0.0963	0.0032	30.27 ***		0.287513
Drug Waiver	-0.0217	0.0031	-6.97 ***		0.235332
Law Waiver	-0.0113	0.0040	-2.86 ***		0.099111
Unique Waiver	0.0000	0.0050	-0.01		0.06934
Medical Waiver	-0.0193	0.0047	-4.15 ***		0.089834
Obese Contract Date	-0.0283	0.0078	-3.6 ***		0.041975
Overweight Contract Date	0.0091	0.0033	2.75 ***		0.322174
<b>Performance Variables</b>					
Deployed Pct	-0.1310	0.0144	-9.08 ***		0.145993
Weight Control Assign	-0.0741	0.0057	-12.8 ***		0.082969
Success Score	0.0032	0.0000	169.6 ***		1662.07
<b>Occupation Variables</b>					
OccFld 2	0.4226	0.0073	30.05 ***		0.00826
OccFld 3	-0.0660	0.0074	-8.86 ***		0.24507
OccFld 4	0.1934	0.0102	17.58 ***		0.021872
OccFld 5	0.2701	0.0271	8.3 ***		0.001756
OccFld 6	0.3654	0.0056	50.16 ***		0.085098

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
OccFld 8	0.2745	0.0082	28.42	***	0.029712
OccFld 11	-0.0391	0.0121	-3.23	***	0.019388
OccFld 13	0.1506	0.0084	17.25	***	0.055061
OccFld 18	0.2344	0.0104	20.02	***	0.016964
OccFld 21	0.1670	0.0097	16.35	***	0.028192
OccFld 23	0.2694	0.0120	18.88	***	0.009419
OccFld 26	0.3592	0.0081	30.67	***	0.015681
OccFld 28	0.3060	0.0084	29.08	***	0.022735
OccFld 30	0.1865	0.0084	20.68	***	0.041946
OccFld 31	0.1696	0.0209	7.62	***	0.003867
OccFld 33	0.2714	0.0106	21.53	***	0.013044
OccFld 34	0.0705	0.0172	4.05	***	0.00706
OccFld 35	0.1228	0.0078	15.38	***	0.094121
OccFld 43	0.2063	0.0240	7.81	***	0.002472
OccFld 44	0.0419	0.0272	1.54		0.002702
OccFld 46	-0.0287	0.0278	-1.03		0.00269
OccFld 55	0.3605	0.0122	19.96	***	0.005186
OccFld 57	0.0068	0.0181	0.37		0.006616
OccFld 58	0.0278	0.0107	2.59	**	0.027087
OccFld 59	0.3142	0.0109	22.3	***	0.010176
OccFld 60	0.2713	0.0080	28.87	***	0.033017
OccFld 61	0.3206	0.0076	32.81	***	0.025892
OccFld 62	0.3056	0.0087	27.91	***	0.018797
OccFld 63	0.3260	0.0079	31.76	***	0.023462
OccFld 64	0.2863	0.0112	20.88	***	0.010566
OccFld 65	0.0826	0.0124	6.55	***	0.015947
OccFld 66	0.1516	0.0133	10.87	***	0.011861
OccFld 68	0.3593	0.0217	11.16	***	0.00139
OccFld 70	0.1257	0.0126	9.63	***	0.013777
OccFld 72	0.3088	0.0104	23.26	***	0.011341
OccFld 73	0.4123	0.0170	12.9	***	0.001366
OccFld 99	0.3018	0.0125	19.07	***	0.009348
Cohort 2004	-0.0077	0.0054	-1.44		0.134352
Cohort 2005	-0.0902	0.0052	-17.26	***	0.141447

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
Cohort 2006	-0.1236	0.0051	-23.57 ***		0.1394
Cohort 2007	-0.1683	0.0051	-31.46 ***		0.1509
Cohort 2008	-0.2459	0.0048	-47.07 ***		0.1624
Cohort 2009	-0.3631	0.0042	-69.13 ***		0.1315
observed P(attribute)=0.4989					
predicted P(attribute)=0.4982					
n =169,123					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 37. E6 Promotion Model 1a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	0.0093	0.0050	1.97 **		0.070753
Hispanic entry	-0.0052	0.0036	-1.4		0.087031
Black	-0.0194	0.0031	-5.61 ***		0.108618
Asian	-0.0126	0.0069	-1.68 *		0.017972
AIAN	-0.0348	0.0081	-3.05 ***		0.006177
NHPI	0.0151	0.0154	1.06		0.007891
race declined	0.0011	0.0031	0.36		0.118968
alien	0.0044	0.0055	0.83		0.046046
# of dependents five YOS	0.0018	0.0010	1.85 *		1.14151
<b>Recruit Variables</b>					
Tier 2	0.0166	0.0084	2.14 **		0.021443
Tier 3	-0.0276	0.0292	-0.74		0.000764
AR+MK	0.0024	0.0001	25.76 ***		108.408
IST Upper Body Strength	0.0005	0.0000	9.5 ***		47.485
IST Run Time	-0.0052	0.0007	-7.19 ***		11.5399
IST Crunches	0.0001	0.0001	1.02		70.3045
Advanced Pay Grade	0.0227	0.0025	9.71 ***		0.315692
Drug Waiver	0.0023	0.0019	1.2		0.258614
Law Waiver	0.0064	0.0023	2.77 ***		0.114051

Variable	dF/dx	Std. Err.	z		x-bar
<b>Recruit Variables</b>					
Unique Waiver	0.0000	0.0030	0		0.087919
Medical Waiver	-0.0035	0.0030	-1.15		0.087093
Obese Contract Date	-0.0118	0.0054	-2.02 **		0.0333
Overweight Contract Date	-0.0029	0.0024	-1.18		0.296046
<b>Occupation Variables</b>					
SDA	0.2159	0.0105	30.74 ***		0.040778
OccFld 2	0.3305	0.0275	17.55 ***		0.010288
OccFld 3	-0.0158	0.0044	-3.33 ***		0.178256
OccFld 4	0.1385	0.0150	12.95 ***		0.026421
OccFld 5	0.0641	0.0320	2.54 **		0.00221
OccFld 6	0.0308	0.0070	4.98 ***		0.0892
OccFld 8	0.0956	0.0128	9.96 ***		0.029685
OccFld 11	-0.0202	0.0071	-2.44 **		0.01791
OccFld 13	-0.0318	0.0043	-5.76 ***		0.051996
OccFld 18	-0.0029	0.0095	-0.3		0.015245
OccFld 21	0.0047	0.0080	0.61		0.027909
OccFld 23	-0.0348	0.0069	-3.63 ***		0.009709
OccFld 26	0.2413	0.0219	16.14 ***		0.015576
OccFld 28	0.0366	0.0101	4.24 ***		0.025264
OccFld 30	0.0051	0.0066	0.79		0.048794
OccFld 31	-0.0126	0.0152	-0.76		0.004813
OccFld 33	-0.0332	0.0070	-3.5 ***		0.014894
OccFld 34	0.0288	0.0138	2.38 **		0.009771
OccFld 35	-0.0406	0.0036	-8.6 ***		0.096513
OccFld 43	-0.0207	0.0151	-1.16		0.003037
OccFld 44	0.0077	0.0168	0.48		0.004565
OccFld 46	0.0251	0.0270	1.05		0.00252
OccFld 55	0.1300	0.0236	7.69 ***		0.007127
OccFld 57	0.0105	0.0129	0.86		0.00818
OccFld 58	-0.0271	0.0059	-3.68 ***		0.020885
OccFld 59	0.0559	0.0155	4.46 ***		0.01132
OccFld 60	0.0251	0.0080	3.53 ***		0.041192
OccFld 61	0.0576	0.0110	6.51 ***		0.02795
OccFld 62	0.0508	0.0122	5.11 ***		0.019026

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
OccFld 63	0.0106	0.0079	1.41		0.02795
OccFld 64	-0.0258	0.0081	-2.56 **		0.009998
OccFld 65	-0.0226	0.0067	-2.85 ***		0.018282
OccFld 66	-0.0224	0.0072	-2.63 ***		0.015514
OccFld 68	0.1090	0.0430	3.46 ***		0.002004
OccFld 70	-0.0056	0.0089	-0.61		0.0157
OccFld 72	0.1497	0.0201	10.6 ***		0.012209
OccFld 73	0.1020	0.0457	3.02 ***		0.001487
OccFld 99	0.0900	0.0150	7.99 ***		0.012643
Cohort 2004	-0.0279	0.0023	-10.84 ***		0.178958
Cohort 2005	-0.0446	0.0022	-18.07 ***		0.16301
Cohort 2006	-0.0482	0.0021	-19.24 ***		0.133594
Cohort 2007	-0.0735	0.0022	-30.51 ***		0.132974
Cohort 2008	-0.0927	0.0024	-34.78 ***		0.128223
Cohort 2009	-0.1058	0.0019	-23.94 ***		0.110953
observed P(attribute)=0.1330					
predicted P(attribute)=0.0615					
n =48,408					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 38. E6 Promotion Model 2a (AFQT) Partial Effects

Variable	dF/dx	Std. Err.	z		x-bar
<b>Demographic Variables</b>					
female	0.0106	0.0041	2.83	***	0.070739
Hispanic entry	-0.0076	0.0025	-2.82	***	0.08704
Black	-0.0160	0.0022	-6.32	***	0.108609
Asian	-0.0143	0.0044	-2.73	***	0.017974
AIAN	-0.0247	0.0055	-3	***	0.006177
NHPI	0.0025	0.0103	0.24		0.007892
race declined	-0.0040	0.0022	-1.78	*	0.11896
alien	-0.0065	0.0035	-1.75	*	0.046051
# of dependents five YOS	0.0030	0.0007	4.03	***	1.14146
<b>Recruit Variables</b>					
Tier 2	0.0120	0.0066	2.02	**	0.021445
Tier 3	-0.0185	0.0235	-0.6		0.000764
AR+MK	0.0015	0.0001	21.02	***	108.409
IST Upper Body Strength	-0.0002	0.0000	-5.21	***	47.4865
IST Run Time	0.0000	0.0005	0.06		11.5398
IST Crunches	0.0000	0.0001	0.48		70.3051
Advanced Pay Grade	0.0176	0.0019	9.84	***	0.315724
Drug Waiver	0.0008	0.0014	0.55		0.25862
Law Waiver	0.0000	0.0017	0.01		0.114043
Unique Waiver	0.0005	0.0023	0.21		0.087887
Medical Waiver	0.0024	0.0023	1.06		0.087102
Obese Contract Date	0.0057	0.0054	1.11		0.033304
Overweight Contract Date	0.0052	0.0020	2.73	***	0.296056
<b>Performance Variables</b>					
Deployed Pct	0.0371	0.0105	3.56	***	0.12184
Weight Control Assign	-0.0377	0.0019	-12.83	***	0.076648
Success Score	0.0005	0.0000	49.87	***	1697.58
<b>Occupation Variables</b>					
SDA	0.1300	0.0084	24.57	***	0.040783
OccFld 2	0.3863	0.0304	19.99	***	0.010289
OccFld 3	-0.0111	0.0034	-3.01	***	0.178253
OccFld 4	0.1546	0.0160	15.28	***	0.026424
OccFld 5	0.0846	0.0328	3.73	***	0.002211

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
OccFld 6	0.0621	0.0080	10.38 ***		0.089209
OccFld 8	0.1318	0.0147	13.83 ***		0.029688
OccFld 11	-0.0166	0.0049	-2.76 ***		0.017912
OccFld 13	-0.0178	0.0036	-4.03 ***		0.052001
OccFld 18	0.0162	0.0097	1.91 *		0.015247
OccFld 21	0.0250	0.0083	3.58 ***		0.027911
OccFld 23	-0.0206	0.0056	-2.72 ***		0.00971
OccFld 26	0.2888	0.0242	19.27 ***		0.015578
OccFld 28	0.0522	0.0103	6.73 ***		0.025267
OccFld 30	0.0149	0.0060	2.77 ***		0.048799
OccFld 31	-0.0077	0.0117	-0.6		0.004814
OccFld 33	-0.0019	0.0092	-0.2		0.014875
OccFld 34	0.0339	0.0127	3.32 ***		0.009772
OccFld 35	-0.0190	0.0033	-4.79 ***		0.096502
OccFld 43	-0.0009	0.0156	-0.06		0.003037
OccFld 44	-0.0019	0.0112	-0.17		0.004566
OccFld 46	0.0051	0.0178	0.3		0.002521
OccFld 55	0.2092	0.0292	11.6 ***		0.007128
OccFld 57	0.0126	0.0110	1.27		0.008181
OccFld 58	-0.0181	0.0044	-3.26 ***		0.020887
OccFld 59	0.0624	0.0149	5.75 ***		0.011322
OccFld 60	0.0434	0.0082	6.77 ***		0.041196
OccFld 61	0.0936	0.0127	10.79 ***		0.027953
OccFld 62	0.0825	0.0137	8.66 ***		0.019028
OccFld 63	0.0197	0.0073	3.11 ***		0.027953
OccFld 64	-0.0093	0.0076	-1.11		0.009999
OccFld 65	-0.0076	0.0060	-1.16		0.018284
OccFld 66	-0.0099	0.0062	-1.44		0.015516
OccFld 68	0.1670	0.0514	5.16 ***		0.002004
OccFld 70	0.0019	0.0075	0.26		0.015702
OccFld 72	0.1718	0.0215	12.73 ***		0.01221
OccFld 73	0.1776	0.0560	5.08 ***		0.001488
OccFld 99	0.0850	0.0141	8.78 ***		0.012644
Cohort 2004	-0.0212	0.0017	-11.22 ***		0.178956

Variable	dF/dx	Std. Err.	z		x-bar
<b>Occupation Variables</b>					
Cohort 2005	-0.0352	0.0017	-20.2	***	0.163027
Cohort 2006	-0.0384	0.0016	-22.36	***	0.133607
Cohort 2007	-0.0547	0.0019	-33.97	***	0.132967
Cohort 2008	-0.0681	0.0022	-37.69	***	0.128236
Cohort 2009	-0.0792	0.0018	-25.12		0.110964
observed P(attrite)=0.1330					
predicted P(attrite)=0.0394					
n =48,403					
*** - Indicates statistical significance at the 1% level					
** - Indicates statistical significance at the 5% level					
* - Indicates statistical significance at the 10% level					

Table 39. Success Score Coefficients for all Stayers (AFQT)

Variable	Coeff	Std. Err.	z
<b>Demographic Variables</b>			
female	-12.6092	1.1423	-11.04
Hispanic entry	7.7735	0.9154	8.49
Black	10.3861	0.9636	10.78
Asian	4.2052	1.6725	2.51
AIAN	-9.5997	2.7015	-3.55
NHPI	12.8834	2.9583	4.36
race declined	0.6344	0.8408	0.75
alien	20.7168	1.2724	16.28
Married entry	6.2731	1.5609	4.02
# of dependents five YOS	2.2942	0.2640	8.69
<b>Recruit Variables</b>			
Tier 2	-13.0964	1.7085	-7.67
Tier 3	-27.9559	7.9092	-3.53
AFQT	0.4917	0.0143	34.32
Open Contract	-5.2280	1.0239	-5.11
Advanced Pay Grade	11.2034	0.5394	20.77
MRCD Parris Island	-12.0375	0.5041	-23.88
Drug Waiver	-2.5705	0.5540	-4.64
Law Waiver	6.2681	0.7083	8.85
Unique Waiver	-1.1675	0.8891	-1.31

Medical Waiver	-14.1135	0.8362	-16.88
Obese at Contract Date	-69.4288	1.3099	-53.00
Overweight Contract Date	-39.8289	0.5346	-74.51
Occupation Variables			
OccFld 2	-7.4462	2.9445	-2.53
OccFld 3	-3.7217	1.3069	-2.85
OccFld 4	-16.9125	2.0931	-8.08
OccFld 5	-16.7916	6.7842	-2.48
OccFld 6	-32.4545	1.4415	-22.51
OccFld 8	-26.2238	1.8054	-14.52
OccFld 11	-2.9039	2.1703	-1.34
OccFld 13	-12.0935	1.5634	-7.74
OccFld 18	-13.6198	2.0995	-6.49
OccFld 21	-24.7648	1.8386	-13.47
OccFld 23	-26.7734	2.8458	-9.41
OccFld 26	-18.5490	2.2131	-8.38
OccFld 28	-20.1151	2.0235	-9.94
OccFld 30	-17.8592	1.7028	-10.49
OccFld 31	-9.7491	4.1202	-2.37
OccFld 33	-59.6925	2.3834	-25.05
OccFld 34	0.8584	3.2561	0.26
OccFld 35	-28.7823	1.4181	-20.30
OccFld 43	-11.5691	4.5130	-2.56
OccFld 44	22.4300	4.9278	4.55
OccFld 46	2.5172	5.1435	0.49
OccFld 55	-44.1927	3.2410	-13.64
OccFld 57	-3.0193	3.3058	-0.91
OccFld 58	-7.3067	1.8992	-3.85
OccFld 59	-6.0978	2.6670	-2.29
OccFld 60	-16.4297	1.7879	-9.19
OccFld 61	-23.1664	1.8807	-12.32
OccFld 62	-25.7933	2.1101	-12.22
OccFld 63	-11.1115	1.9877	-5.59
OccFld 64	-20.1301	2.6366	-7.63
OccFld 65	-6.6684	2.2432	-2.97
OccFld 66	-14.0599	2.5894	-5.43
OccFld 68	-43.6180	6.6138	-6.60
OccFld 70	-5.0408	2.4091	-2.09
OccFld 72	-7.9586	2.4924	-3.19
OccFld 73	-19.2575	6.0719	-3.17

OccFld 99	10.5294	2.9228	3.60
Cohort 2004	5.1935	0.9129	5.69
Cohort 2005	2.0843	0.9010	2.31
Cohort 2006	3.6586	0.9050	4.04
Cohort 2007	-2.4872	0.9321	-2.67
Cohort 2008	-0.5051	0.9104	-0.55
Cohort 2009	11.4185	0.9418	12.12
_cons	1661.545	1.696961	979.13

Table 40. Success Score Coefficients for all Stayers (AFQT Categories)

Variable	OLS Coeff	Std. Err.	z	
<b>Demographic Variables</b>				
female	-12.7225	1.1427	-11.13	***
Hispanic entry	6.9263	0.9146	7.57	***
Black	10.0076	0.9635	10.39	***
Asian	3.1573	1.6745	1.89	*
ALAN	-10.3810	2.7003	-3.84	***
NHPI	12.0509	2.9514	4.08	***
race declined	0.4521	0.8407	0.54	
alien	19.2461	1.2728	15.12	***
Married entry	6.5960	1.5609	4.23	***
# of dependents five YOS	2.1776	0.2638	8.25	***
<b>Recruit Variables</b>				
Tier 2	-12.7696	1.7093	-7.47	***
Tier 3	-28.1848	7.9264	-3.56	***
AFQT Cat 1	19.0420	1.2069	15.78	***
AFQT Cat 2	9.1561	0.6182	14.81	***
AFQT Cat 3b	-12.6107	0.7023	-17.96	***
AFQT Cat 4	-14.2326	2.0985	-6.78	***
AFQT 3b+	16.0542	0.9831	16.33	***
Open Contract	-5.2937	1.0275	-5.15	***
Advanced Paygrade	11.4500	0.5396	21.22	***
MRCDPI	-11.9349	0.5040	-23.68	***
Drug Waiver	-2.5535	0.5543	-4.61	***
Law Waiver	6.3962	0.7088	9.02	***
Unique Waiver	-1.3340	0.8894	-1.5	
Medical Waiver	-14.0896	0.8354	-16.87	***
Obese Contract Date	-69.3440	1.3093	-52.96	***
Overweight Contract Date	-39.7601	0.5344	-74.4	***

Variable	OLS Coeff	Std. Err.	z	
<b>Occupation Variables</b>				
OccFld 2	-13.8772	2.8283	-4.91	***
OccFld 3	-12.5829	1.2942	-9.72	***
OccFld 4	-19.2465	1.9988	-9.63	***
OccFld 5	-19.2924	6.4761	-2.98	***
OccFld 6	-37.1069	1.3963	-26.57	***
OccFld 8	-29.3282	1.7487	-16.77	***
OccFld 11	-6.1283	2.0887	-2.93	***
OccFld 13	-17.6949	1.5166	-11.67	***
OccFld 18	-15.5908	2.0339	-7.67	***
OccFld 21	-25.7096	1.7602	-14.61	***
OccFld 23	-27.6890	2.6903	-10.29	***
OccFld 26	-22.9161	2.1075	-10.87	***
OccFld 28	-21.4400	1.9298	-11.11	***
OccFld 30	-19.9205	1.6356	-12.18	***
OccFld 31	-7.6686	4.0161	-1.91	*
OccFld 33	-60.1721	2.3155	-25.99	***
OccFld 34	0.9681	3.0985	0.31	
OccFld 35	-32.1335	1.3740	-23.39	***
OccFld 43	-12.9323	4.2199	-3.06	***
OccFld 44	21.6733	4.7843	4.53	***
OccFld 46	1.8517	4.8877	0.38	
OccFld 55	-43.4205	3.1440	-13.81	***
OccFld 57	-6.6547	3.1357	-2.12	**
OccFld 58	-8.4263	1.8205	-4.63	***
OccFld 59	-6.8132	2.5399	-2.68	***
OccFld 60	-16.8847	1.7046	-9.91	***
OccFld 61	-25.1348	1.8050	-13.93	***
OccFld 62	-24.6648	2.0169	-12.23	***
OccFld 63	-12.6845	1.8895	-6.71	***
OccFld 64	-18.9136	2.4614	-7.68	***
OccFld 65	-8.5940	2.1410	-4.01	***
OccFld 66	-15.7884	2.4824	-6.36	***
OccFld 68	-42.5728	6.1766	-6.89	***
OccFld 70	-5.8981	2.2986	-2.57	**
OccFld 72	-8.5521	2.3712	-3.61	***
OccFld 73	-25.7054	5.7948	-4.44	***
OccFld 99	5.2312	2.8050	1.87	*
Cohort 2004	5.2966	0.8813	6.01	***

Variable	OLS Coeff	Std. Err.	z
<b>Occupation Variables</b>			
Cohort 2005	1.7375	0.8691	2 **
Cohort 2006	3.7716	0.8742	4.31 ***
Cohort 2007	-0.1066	0.9013	-0.12
Cohort 2008	1.6827	0.8837	1.9 *
Cohort 2009	14.1163	0.9219	15.31 ***
_cons	1570.8280	2.7832	564.41 ***
*** - Indicates statistical significance at the 1% level			
** - Indicates statistical significance at the 5% level			
* - Indicates statistical significance at the 10% level			

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## APPENDIX B. PROBIT REGRESSION COEFFICIENTS

Table 41. Attrition Model 1 Probit Coefficients

Variable	dF/dx	Std. Err.	z	
female	0.1413	0.0158	8.97	***
Hispanic entry	-0.1423	0.0151	-9.41	***
Black	0.0741	0.0134	5.52	***
Asian	-0.1099	0.0281	-3.91	***
AIAN	-0.1044	0.0427	-2.44	**
NHPI	-0.1368	0.0484	-2.83	***
race declined	-0.0093	0.0132	-0.70	
alien	-0.1612	0.0218	-7.39	***
# of dependents five YOS	-0.0298	0.0225	-1.32	
Tier 2	0.2514	0.0216	11.65	***
Tier 3	-0.0510	0.1037	-0.49	
AR+MK	-0.0031	0.0002	-14.29	***
IST Upper Body Strength	-0.0014	0.0002	-8.00	***
IST Run Time	0.0148	0.0023	6.55	***
IST Crunches	-0.0005	0.0002	-2.05	**
Open Contract	0.0562	0.0142	3.95	***
Advanced Pay Grade	-0.0236	0.0083	-2.86	***
MCRD Parris Island	0.0631	0.0077	8.21	***
Drug Waiver	0.3647	0.0066	54.97	***
Law Waiver	0.1984	0.0083	23.91	***
Unique Waiver	0.2495	0.0107	23.36	***
Medical Waiver	0.2731	0.0101	27.05	***
Obese at Contract Date	-0.0797	0.0186	-4.28	***
Overweight Contract Date	-0.0555	0.0083	-6.66	***
OccFld 2	-0.2279	0.0504	-4.52	***
OccFld 3	0.2072	0.0183	11.35	***
OccFld 4	-0.0365	0.0301	-1.21	
OccFld 5	-0.0313	0.0929	-0.34	
OccFld 6	-0.0565	0.0210	-2.70	***
OccFld 8	0.0079	0.0270	0.29	
OccFld 11	-0.0897	0.0315	-2.85	***
OccFld 13	-0.0926	0.0233	-3.98	***
OccFld 18	0.1399	0.0306	4.57	***
OccFld 21	-0.0637	0.0279	-2.28	**
OccFld 23	0.1355	0.0386	3.51	***

Variable	dF/dx	Std. Err.	z
OccFld 26	-0.1009	0.0377	-2.68 ***
OccFld 28	-0.0355	0.0311	-1.14
OccFld 30	0.0415	0.0235	1.77 *
OccFld 31	-0.1753	0.0625	-2.81 ***
OccFld 33	0.0408	0.0337	1.21
OccFld 34	0.0714	0.0444	1.61
OccFld 35	0.0052	0.0203	0.26
OccFld 43	-0.1701	0.0856	-1.99 **
OccFld 44	-0.1284	0.0748	-1.72 *
OccFld 46	-0.0991	0.0773	-1.28
OccFld 55	-0.0810	0.0586	-1.38
OccFld 57	0.0700	0.0483	1.45
OccFld 58	-0.0087	0.0282	-0.31
OccFld 59	0.0624	0.0401	1.56
OccFld 60	-0.1262	0.0272	-4.65 ***
OccFld 61	-0.1072	0.0295	-3.64 ***
OccFld 62	-0.1347	0.0333	-4.04 ***
OccFld 63	0.0064	0.0297	0.21
OccFld 64	-0.2464	0.0457	-5.40 ***
OccFld 65	-0.1507	0.0365	-4.13 ***
OccFld 66	-0.1549	0.0389	-3.98 ***
OccFld 68	-0.0287	0.1037	-0.28
OccFld 70	-0.0765	0.0361	-2.12 **
OccFld 72	0.0456	0.0380	1.20
OccFld 73	-0.2305	0.1227	-1.88 *
OccFld 99	1.0869	0.0296	36.67 ***
Cohort 2004	-0.0006	0.0139	-0.04
Cohort 2005	0.0064	0.0136	0.47
Cohort 2006	-0.0544	0.0139	-3.92 ***
Cohort 2007	0.2031	0.0140	14.50 ***
Cohort 2008	0.2755	0.0137	20.18 ***
Cohort 2009	0.4367	0.0140	31.17 ***
Constant	-1.3421	0.0403	-33.34 ***

Table 42. Attrition Model 2 Probit Coefficients

Variable	dF/dx	Std. Err.	z	
female	0.1580	0.0178	8.89	***
Hispanic entry	-0.1133	0.0171	-6.62	***
Black	0.0477	0.0151	3.15	***
Asian	-0.0771	0.0317	-2.43	**
AIAN	-0.1306	0.0475	-2.75	***
NHPI	-0.0787	0.0546	-1.44	
race declined	0.0082	0.0149	0.55	
alien	-0.0198	0.0247	-0.80	
# of dependents five YOS	0.0328	0.0255	1.29	
Tier 2	0.1966	0.0243	8.10	***
Tier 3	-0.1443	0.1136	-1.27	
AR+MK	0.0006	0.0002	2.49	**
IST Upper Body Strength	0.0080	0.0002	39.12	***
IST Run Time	-0.0343	0.0030	-11.51	***
IST Crunches	0.0009	0.0003	3.34	***
Open Contract	0.0257	0.0159	1.62	
Advanced Pay Grade	0.0016	0.0092	0.17	
MCRD Parris Island	-0.0399	0.0086	-4.62	***
Drug Waiver	0.3223	0.0074	43.68	***
Law Waiver	0.2138	0.0093	23.05	***
Unique Waiver	0.2269	0.0119	19.04	***
Medical Waiver	0.2075	0.0113	18.41	***
Obese at Contract Date	-0.2337	0.0207	-11.31	***
Overweight Contract Date	-0.1226	0.0094	-13.03	***
Success Score	-0.0062	0.0000	-146.06	***
OccFld 2	-0.2775	0.0555	-5.00	***
OccFld 3	0.1203	0.0206	5.85	***
OccFld 4	-0.1269	0.0336	-3.77	***
OccFld 5	-0.2016	0.1078	-1.87	*
OccFld 6	-0.1731	0.0234	-7.40	***
OccFld 8	-0.1462	0.0304	-4.81	***
OccFld 11	-0.1142	0.0355	-3.22	***
OccFld 13	-0.1417	0.0261	-5.44	***
OccFld 18	0.1146	0.0339	3.38	***
OccFld 21	-0.1613	0.0310	-5.20	***
OccFld 23	0.0295	0.0424	0.69	
OccFld 26	-0.1429	0.0411	-3.48	***
OccFld 28	-0.1073	0.0347	-3.09	***

Variable	dF/dx	Std. Err.	z
OccFld 30	-0.0470	0.0264	-1.78 *
OccFld 31	-0.1464	0.0688	-2.13 **
OccFld 33	-0.2457	0.0376	-6.54 ***
OccFld 34	0.1179	0.0493	2.39 **
OccFld 35	-0.1157	0.0227	-5.09 ***
OccFld 43	-0.1803	0.0933	-1.93 *
OccFld 44	0.0296	0.0837	0.35
OccFld 46	-0.1034	0.0870	-1.19
OccFld 55	-0.1840	0.0632	-2.91 ***
OccFld 57	0.0796	0.0539	1.48
OccFld 58	-0.0573	0.0314	-1.82 *
OccFld 59	-0.0060	0.0454	-0.13
OccFld 60	-0.2511	0.0308	-8.15 ***
OccFld 61	-0.2475	0.0330	-7.51 ***
OccFld 62	-0.2829	0.0373	-7.58 ***
OccFld 63	-0.0687	0.0334	-2.06 **
OccFld 64	-0.3369	0.0505	-6.67 ***
OccFld 65	-0.1894	0.0406	-4.66 ***
OccFld 66	-0.2222	0.0435	-5.10 ***
OccFld 68	-0.2792	0.1156	-2.42 **
OccFld 70	-0.1076	0.0406	-2.65 ***
OccFld 72	-0.0037	0.0424	-0.09
OccFld 73	-0.2608	0.1302	-2.00 **
OccFld 99	0.5570	0.0382	14.59 ***
Cohort 2004	-0.0436	0.0155	-2.82 ***
Cohort 2005	-0.0582	0.0152	-3.82 ***
Cohort 2006	-0.1145	0.0155	-7.39 ***
Cohort 2007	0.0528	0.0158	3.35 ***
Cohort 2008	0.1617	0.0151	10.68 ***
Cohort 2009	0.4253	0.0153	27.72 ***
Constant	8.6937	0.0839	103.58 ***

Table 43. Reenlistment Model 1 Probit Coefficients

Variable	dF/dx	Std. Err.	z
female	0.0153	0.0150	1.02
Hispanic entry	0.0101	0.0129	0.78
Black	0.2736	0.0126	21.67 ***
Asian	-0.0018	0.0245	-0.07
AIAN	-0.1196	0.0411	-2.91 ***
NHPI	0.2463	0.0409	6.03 ***
race declined	0.0112	0.0116	0.96
alien	0.1055	0.0179	5.91 ***
# of dependents five YOS	0.3573	0.0035	101.80 ***
Tier 2	0.0031	0.0234	0.13
Tier 3	-0.2766	0.1095	-2.53 **
AR+MK	-0.0022	0.0002	-10.64 ***
IST Upper Body Strength	0.0022	0.0002	13.61 ***
IST Run Time	-0.0282	0.0024	-11.64 ***
IST Crunches	0.0011	0.0002	5.25 ***
Advanced Pay Grade	0.1068	0.0076	14.04 ***
Drug Waiver	-0.0260	0.0074	-3.50 ***
Law Waiver	0.0121	0.0093	1.30
Unique Waiver	0.0093	0.0117	0.79
Medical Waiver	-0.0587	0.0112	-5.25 ***
Obese Contract Date	-0.2211	0.0187	-11.80 ***
Overweight Contract Date	-0.0760	0.0079	-9.68 ***
OccFld 2	0.0859	0.0384	2.24 **
OccFld 3	-0.4597	0.0170	-27.11 ***
OccFld 4	-0.0140	0.0266	-0.53
OccFld 5	0.1023	0.0786	1.30
OccFld 6	-0.1696	0.0189	-9.00 ***
OccFld 8	-0.1788	0.0247	-7.24 ***
OccFld 11	-0.3016	0.0286	-10.55 ***
OccFld 13	-0.2643	0.0210	-12.61 ***
OccFld 18	-0.2746	0.0304	-9.03 ***
OccFld 21	-0.2118	0.0251	-8.43 ***
OccFld 23	-0.1596	0.0375	-4.25 ***
OccFld 26	-0.0835	0.0311	-2.69 ***
OccFld 28	-0.0159	0.0269	-0.59
OccFld 30	-0.1197	0.0217	-5.53 ***
OccFld 31	-0.1219	0.0540	-2.26 **
OccFld 33	-0.1475	0.0323	-4.57 ***

Variable	dF/dx	Std. Err.	z	
OccFld 34	0.1552	0.0407	3.81	***
OccFld 35	-0.2308	0.0187	-12.37	***
OccFld 43	0.0941	0.0662	1.42	
OccFld 44	0.2843	0.0621	4.58	***
OccFld 46	-0.2056	0.0664	-3.10	***
OccFld 55	0.1276	0.0470	2.71	***
OccFld 57	0.0521	0.0427	1.22	
OccFld 58	-0.4124	0.0262	-15.71	***
OccFld 59	-0.0763	0.0359	-2.13	**
OccFld 60	-0.0278	0.0232	-1.20	
OccFld 61	-0.1225	0.0255	-4.80	***
OccFld 62	-0.2175	0.0287	-7.58	***
OccFld 63	-0.0600	0.0261	-2.30	**
OccFld 64	-0.1833	0.0360	-5.09	***
OccFld 65	-0.0389	0.0301	-1.29	
OccFld 66	0.0439	0.0330	1.33	
OccFld 68	0.1915	0.0857	2.24	**
OccFld 70	-0.0987	0.0317	-3.12	***
OccFld 72	-0.1453	0.0345	-4.21	***
OccFld 73	-0.0317	0.0896	-0.35	
OccFld 99	-0.0330	0.0364	-0.91	
Cohort 2004	0.2255	0.0125	17.97	***
Cohort 2005	0.1014	0.0125	8.14	***
Cohort 2006	-0.0688	0.0128	-5.40	***
Cohort 2007	-0.1780	0.0131	-13.58	***
Cohort 2008	-0.2852	0.0131	-21.76	***
Cohort 2009	-0.2441	0.0137	-17.77	***
Constant	-0.3357	0.0405	-8.28	***

Table 44. Reenlistment Model 2 Probit Coefficients

Variable	dF/dx	Std. Err.	z
female	-0.0409	0.0154	-2.66 ***
Hispanic entry	-0.0206	0.0134	-1.54
Black	0.2757	0.0130	21.15 ***
Asian	-0.0567	0.0254	-2.23 **
AIAN	-0.1129	0.0424	-2.66 ***
NHPI	0.1989	0.0425	4.68 ***
race declined	-0.0223	0.0120	-1.86 *
alien	0.0289	0.0185	1.56
# of dependents five YOS	0.3492	0.0036	96.29 ***
Tier 2	0.0305	0.0242	1.26
Tier 3	-0.2049	0.1122	-1.83 *
AR+MK	-0.0046	0.0002	-21.68 ***
IST Upper Body Strength	-0.0028	0.0002	-16.05 ***
IST Run Time	0.0001	0.0023	0.04
IST Crunches	0.0007	0.0002	3.18 ***
Advanced Pay Grade	0.0913	0.0078	11.64 ***
Drug Waiver	-0.0137	0.0077	-1.78 *
Law Waiver	-0.0068	0.0097	-0.71
Unique Waiver	0.0123	0.0121	1.02
Medical Waiver	-0.0247	0.0115	-2.15 **
Obese Contract Date	-0.1090	0.0195	-5.59 ***
Overweight Contract Date	-0.0268	0.0081	-3.31 ***
Deployed Pct	-2.2083	0.0388	-56.94 ***
Success Score	0.0038	0.0000	94.21 ***
occ_fld_2	0.4007	0.0397	10.09 ***
occ_fld_3	-0.1531	0.0181	-8.45 ***
occ_fld_4	0.2147	0.0276	7.79 ***
occ_fld_5	0.2207	0.0812	2.72 ***
occ_fld_6	0.1434	0.0198	7.25 ***
occ_fld_8	0.1332	0.0258	5.17 ***
occ_fld_11	-0.1333	0.0297	-4.49 ***
occ_fld_13	0.0002	0.0219	0.01
occ_fld_18	-0.0626	0.0315	-1.99 **
occ_fld_21	-0.0153	0.0259	-0.59
occ_fld_23	0.0450	0.0389	1.16
occ_fld_26	0.1231	0.0320	3.85 ***
occ_fld_28	0.1294	0.0278	4.66 ***
occ_fld_30	0.0389	0.0225	1.73 *

Variable	dF/dx	Std. Err.	z	
occ_fld_31	-0.0968	0.0559	-1.73	*
occ_fld_33	0.1909	0.0334	5.71	***
occ_fld_34	0.1606	0.0417	3.85	***
occ_fld_35	0.0608	0.0196	3.11	***
occ_fld_43	0.2085	0.0673	3.1	***
occ_fld_44	0.1715	0.0636	2.69	***
occ_fld_46	-0.1703	0.0689	-2.47	**
occ_fld_55	0.2325	0.0482	4.83	***
occ_fld_57	0.1805	0.0438	4.12	***
occ_fld_58	-0.3191	0.0271	-11.77	***
occ_fld_59	-0.0155	0.0368	-0.42	
occ_fld_60	0.1261	0.0239	5.27	***
occ_fld_61	0.1259	0.0263	4.79	***
occ_fld_62	-0.0629	0.0295	-2.13	**
occ_fld_63	0.0579	0.0268	2.16	**
occ_fld_64	-0.0858	0.0369	-2.33	**
occ_fld_65	0.1112	0.0309	3.6	***
occ_fld_66	0.1752	0.0340	5.15	***
occ_fld_68	0.4317	0.0879	4.91	***
occ_fld_70	-0.0216	0.0326	-0.66	
occ_fld_72	-0.0052	0.0354	-0.15	
occ_fld_73	0.2745	0.0913	3.01	***
occ_fld_99	0.0654	0.0373	1.75	*
cohort_2004	0.2215	0.0129	17.16	***
cohort_2005	0.0986	0.0128	7.68	***
cohort_2006	-0.1191	0.0132	-9.05	***
cohort_2007	-0.2474	0.0136	-18.21	***
cohort_2008	-0.3933	0.0137	-28.77	***
cohort_2009	-0.4024	0.0144	-27.97	***
Constant	-6.4554	0.0781	-82.66	***

Table 45. E5 Promotion Model 1 Probit Coefficients

Variable	dF/dx	Std. Err.	z
female	-0.0223	0.0145	-1.54
Hispanic entry	0.0295	0.0124	2.38 **
Black	0.0104	0.0125	0.83
Asian	0.1251	0.0230	5.44 ***
AIAN	-0.2420	0.0386	-6.27 ***
NHPI	0.1649	0.0401	4.11 ***
race declined	0.0201	0.0112	1.79 *
alien	0.2329	0.0175	13.35 ***
# of dependents five YOS	0.2002	0.0035	57.62 ***
Tier 2	-0.0812	0.0221	-3.67 ***
Tier 3	-0.4040	0.1020	-3.96 ***
AR+MK	0.0063	0.0002	32.63 ***
IST Upper Body Strength	0.0063	0.0002	40.2 ***
IST Run Time	-0.0514	0.0022	-23 ***
IST Crunches	0.0009	0.0002	4.23 ***
Advanced Pay Grade	0.2268	0.0073	31.03 ***
Drug Waiver	-0.0555	0.0071	-7.8 ***
Law Waiver	0.0215	0.0090	2.38 **
Unique Waiver	-0.0193	0.0115	-1.68 *
Medical Waiver	-0.1207	0.0105	-11.44 ***
Obese Contract Date	-0.3070	0.0173	-17.76 ***
Overweight Contract Date	-0.0930	0.0074	-12.56 ***
OccFld 2	0.9871	0.0416	23.73 ***
OccFld 3	-0.2879	0.0165	-17.45 ***
OccFld 4	0.2563	0.0259	9.91 ***
OccFld 5	0.5028	0.0788	6.38 ***
OccFld 6	0.6031	0.0185	32.63 ***
OccFld 8	0.3826	0.0237	16.15 ***
OccFld 11	-0.1555	0.0273	-5.7 ***
OccFld 13	0.1618	0.0201	8.07 ***
OccFld 18	0.3687	0.0285	12.94 ***
OccFld 21	0.1407	0.0240	5.86 ***
OccFld 23	0.3740	0.0354	10.55 ***
OccFld 26	0.7108	0.0313	22.68 ***
OccFld 28	0.5550	0.0266	20.89 ***
OccFld 30	0.2447	0.0211	11.58 ***
OccFld 31	0.2863	0.0524	5.47 ***
OccFld 33	0.2053	0.0312	6.59 ***

Variable	dF/dx	Std. Err.	z	
OccFld 34	0.1380	0.0403	3.43	***
OccFld 35	0.0100	0.0182	0.55	
OccFld 43	0.3332	0.0649	5.13	***
OccFld 44	0.2277	0.0622	3.66	***
OccFld 46	-0.0683	0.0625	-1.09	
OccFld 55	0.6266	0.0491	12.75	***
OccFld 57	-0.0277	0.0417	-0.67	
OccFld 58	-0.0592	0.0244	-2.42	**
OccFld 59	0.6537	0.0362	18.04	***
OccFld 60	0.4423	0.0231	19.19	***
OccFld 61	0.5274	0.0250	21.06	***
OccFld 62	0.4751	0.0277	17.12	***
OccFld 63	0.6325	0.0263	24.06	***
OccFld 64	0.4852	0.0344	14.09	***
OccFld 65	0.0621	0.0291	2.13	**
OccFld 66	0.1939	0.0324	5.99	***
OccFld 68	0.5533	0.0877	6.31	***
OccFld 70	0.1923	0.0304	6.34	***
OccFld 72	0.6011	0.0341	17.62	***
OccFld 73	0.9066	0.0965	9.39	***
OccFld 99	0.6589	0.0399	16.52	***
Cohort 2004	-0.0145	0.0123	-1.18	
Cohort 2005	-0.1868	0.0121	-15.49	***
Cohort 2006	-0.2423	0.0122	-19.93	***
Cohort 2007	-0.3691	0.0124	-29.73	***
Cohort 2008	-0.5382	0.0123	-43.69	***
Cohort 2009	-0.7996	0.0131	-60.97	***
Constant	-0.1393	0.0381	-3.66	***

Table 46. E6 Promotion Model 1 Probit Coefficients

Variable	dF/dx	Std. Err.	z
female	0.0695	0.0368	1.89 *
Hispanic entry	0.0004	0.0309	0.01
Black	-0.1453	0.0313	-4.65 ***
Asian	-0.0417	0.0661	-0.63
AIAN	-0.3433	0.1239	-2.77 ***
NHPI	0.1655	0.1062	1.56
race declined	0.0218	0.0246	0.89
alien	0.1039	0.0425	2.45 **
# of dependents five YOS	0.0198	0.0079	2.5 **
Tier 2	0.0680	0.0574	1.19
Tier 3	-0.3780	0.3800	-0.99
AR+MK	0.0150	0.0005	28.76 ***
IST Upper Body Strength	0.0040	0.0004	9.97 ***
IST Run Time	-0.0441	0.0058	-7.56 ***
IST Crunches	0.0005	0.0005	0.91
Advanced Pay Grade	0.1579	0.0180	8.76 ***
Drug Waiver	0.0158	0.0154	1.03
Law Waiver	0.0404	0.0188	2.15 **
Unique Waiver	0.0222	0.0243	0.91
Medical Waiver	-0.0364	0.0244	-1.49
Obese Contract Date	-0.1120	0.0509	-2.2 **
Overweight Contract Date	-0.0282	0.0199	-1.42
SDA	0.9901	0.0316	31.33 ***
OccFld 2	1.2247	0.0724	16.93 ***
OccFld 3	-0.1630	0.0410	-3.98 ***
OccFld 4	0.6884	0.0546	12.62 ***
OccFld 5	0.3440	0.1534	2.24 **
OccFld 6	0.2237	0.0439	5.1 ***
OccFld 8	0.5175	0.0542	9.55 ***
OccFld 11	-0.1815	0.0776	-2.34 **
OccFld 13	-0.3221	0.0559	-5.76 ***
OccFld 18	-0.0456	0.0803	-0.57
OccFld 21	0.0202	0.0612	0.33
OccFld 23	-0.4062	0.1035	-3.92 ***
OccFld 26	0.9518	0.0639	14.89 ***
OccFld 28	0.2060	0.0586	3.52 ***
OccFld 30	0.0407	0.0511	0.8
OccFld 31	-0.0681	0.1464	-0.47

Variable	dF/dx	Std. Err.	z	
OccFld 33	-0.3036	0.0999	-3.04	***
OccFld 34	0.1430	0.0844	1.69	*
OccFld 35	-0.3918	0.0499	-7.85	***
OccFld 43	-0.2991	0.1671	-1.79	*
OccFld 44	0.0314	0.1240	0.25	
OccFld 46	0.1025	0.1689	0.61	
OccFld 55	0.6334	0.0866	7.31	***
OccFld 57	0.0102	0.0925	0.11	
OccFld 58	-0.3040	0.0730	-4.17	***
OccFld 59	0.3150	0.0787	4	***
OccFld 60	0.1622	0.0510	3.18	***
OccFld 61	0.3416	0.0558	6.12	***
OccFld 62	0.3187	0.0639	4.99	***
OccFld 63	0.0735	0.0574	1.28	
OccFld 64	-0.2771	0.0989	-2.8	***
OccFld 65	-0.2487	0.0753	-3.3	***
OccFld 66	-0.2223	0.0806	-2.76	***
OccFld 68	0.5607	0.1677	3.34	***
OccFld 70	-0.0671	0.0778	-0.86	
OccFld 72	0.6963	0.0700	9.95	***
OccFld 73	0.4982	0.1847	2.7	***
OccFld 99	0.4687	0.0639	7.33	***
Cohort 2004	-0.2550	0.0236	-10.81	***
Cohort 2005	-0.4608	0.0252	-18.29	***
Cohort 2006	-0.5290	0.0271	-19.53	***
Cohort 2007	-1.0269	0.0334	-30.79	***
Cohort 2008	-1.6846	0.0482	-34.92	***
Cohort 2009	-2.5621	0.1063	-24.1	***
Constant	-1.45534	0.0965782	-15.07	***

Table 47. E6 Promotion Model 2 Probit Coefficients

Variable	dF/dx	Std. Err.	z	
female	0.1095	0.0397	2.76	***
Hispanic entry	-0.0510	0.0330	-1.55	
Black	-0.1782	0.0335	-5.32	***
Asian	-0.1334	0.0708	-1.88	*
AIAN	-0.3685	0.1334	-2.76	***
NHPI	0.0815	0.1124	0.73	
race declined	-0.0352	0.0263	-1.34	
alien	-0.0121	0.0454	-0.27	
# of dependents five YOS	0.0395	0.0085	4.67	***
Tier 2	0.0737	0.0614	1.2	
Tier 3	-0.3495	0.4484	-0.78	
AR+MK	0.0139	0.0006	24.99	***
IST Upper Body Strength	-0.0021	0.0004	-4.87	***
IST Run Time	-0.0011	0.0062	-0.18	
IST Crunches	0.0002	0.0006	0.31	
Advanced Pay Grade	0.1700	0.0193	8.82	***
Drug Waiver	0.0062	0.0165	0.37	
Law Waiver	-0.0114	0.0201	-0.57	
Unique Waiver	0.0319	0.0261	1.22	
Medical Waiver	0.0187	0.0263	0.71	
Obese Contract Date	0.0527	0.0562	0.94	
Overweight Contract Date	0.0528	0.0216	2.45	**
Deployed Pct	0.4481	0.1192	3.76	***
Weight Control Assign	-0.7018	0.0560	-12.52	***
Success Score	0.0059	0.0001	50.11	***
SDA	0.8345	0.0332	25.17	***
OccFld 2	1.5303	0.0787	19.45	***
OccFld 3	-0.1609	0.0456	-3.53	***
OccFld 4	0.8887	0.0591	15.03	***
OccFld 5	0.5437	0.1589	3.42	***
OccFld 6	0.5074	0.0484	10.48	***
OccFld 8	0.7996	0.0591	13.54	***
OccFld 11	-0.2207	0.0840	-2.63	***
OccFld 13	-0.2465	0.0614	-4.02	***
OccFld 18	0.1489	0.0855	1.74	*
OccFld 21	0.2222	0.0660	3.37	***
OccFld 23	-0.3342	0.1127	-2.96	***
OccFld 26	1.2351	0.0686	18.02	***

Variable	dF/dx	Std. Err.	z	
OccFld 28	0.3797	0.0632	6.01	***
OccFld 30	0.1562	0.0550	2.84	***
OccFld 31	-0.0392	0.1594	-0.25	
OccFld 33	0.0337	0.1097	0.31	
OccFld 34	0.2471	0.0909	2.72	***
OccFld 35	-0.2184	0.0545	-4.01	***
OccFld 43	-0.1110	0.1814	-0.61	
OccFld 44	-0.0501	0.1327	-0.38	
OccFld 46	-0.0161	0.1853	-0.09	
OccFld 55	1.0440	0.0925	11.28	***
OccFld 57	0.0545	0.1010	0.54	
OccFld 58	-0.2932	0.0790	-3.71	***
OccFld 59	0.4389	0.0838	5.24	***
OccFld 60	0.3561	0.0550	6.47	***
OccFld 61	0.6291	0.0602	10.45	***
OccFld 62	0.5813	0.0682	8.52	***
OccFld 63	0.1802	0.0621	2.9	***
OccFld 64	-0.1485	0.1065	-1.39	
OccFld 65	-0.1288	0.0813	-1.58	
OccFld 66	-0.1412	0.0875	-1.61	
OccFld 68	0.9076	0.1792	5.06	***
OccFld 70	0.0035	0.0834	0.04	
OccFld 72	0.9117	0.0752	12.12	***
OccFld 73	0.9040	0.1904	4.75	***
OccFld 99	0.5584	0.0684	8.16	***
Cohort 2004	-0.2843	0.0253	-11.24	***
Cohort 2005	-0.5518	0.0270	-20.41	***
Cohort 2006	-0.6584	0.0291	-22.61	***
Cohort 2007	-1.2354	0.0361	-34.19	***
Cohort 2008	-1.9879	0.0527	-37.75	***
Cohort 2009	-3.0169	0.1194	-25.26	***
Constant	-11.7360	0.2309	-50.83	***

## APPENDIX C. COMPOSITE SCORE CALCULATION

Table 48. Composite Score Calculation (from HQMC, 2006)

1. Rifle Marksmanship Score	=				=	
		Score				Rating
2. PFT	=				=	
		Score				Rating
3. CFT	=				=	
		Score				Rating
4. Subtotal (line 1 + 2+ 3)					=	
5. GMP Score (line 4 divided by 3) *					=	
6. GMP Score (from line 4)*	=	x	100	=		
7. Average Duty Proficiency	=	x	100	=		
8. Average Conduct	=	x	100	=		
9. TIG (months)	=	x	5	=		
10. TIS (months) (computed from AFADBD)	=	x	2	=		
11. DI/Recruiter/MSG Bonus(100pts)	=	x	1	=		
12. Self-Education Bonus: (a maximum of 100 points)						
a. MCI/Extension School	=	x	15	=		
13. Total Score (Sum lines 6-12)					=	
* General Military Proficiency						

Table 49. Rifle Score Conversion (after HQMC, 2006)

2003 to 2006		2007 to 2009	
Score	Rating	Score	Rating
240-250	5.0	336-350	5.0
235-239	4.9	328-335	4.9
230-234	4.8	320-327	4.8
225-229	4.7	312-319	4.7
220-224	4.6	305-311	4.6
215-219	4.4	292-304	4.4
210-214	4.2	279-291	4.2
205-209	3.8	272-278	3.8
200-204	3.6	264-271	3.6
195-199	3.4	257-263	3.4
190-194	3.0	250-256	3.0
000-189	0.0	000-249	0.0

Table 50. PFT Score Conversion (17-26) (from HQMC, 2006)

CLASS	SCORE	RATING
1st	280-300	5
	270-279	4.9
	260-269	4.8
	250-259	4.7
	240-249	4.6
	225-239	4.5
2nd	215-224	4.4
	205-214	4.3
	195-204	4.2
	185-194	4.1
	175-184	4
3rd	170-174	3.9
	160-169	3.8
	150-159	3.7
	140-149	3.6
Unqual	135-139	3.5
	0-134	0

Table 51. PFT Score Conversion (27-39) (from HQMC, 2006)

CLASS	SCORE	RATING
1st	280-300	5
	270-279	4.9
	260-269	4.8
	250-259	4.7
	240-249	4.6
	225-239	4.5
	215-224	4.4
	205-214	4.3
	200-204	4.2
	195-199	4.2
2nd	185-194	4.1
	175-184	4
	170-174	3.9
	160-169	3.8
	150-159	3.7
	140-149	3.6
3rd	135-139	3.5
	110-134	3
	0-109	0

Table 52. CFT Score Conversion (from HQMC, 2006)

CLASS	SCORE	RATING
1st	300	5
	294—299	4.9
	288—293	4.8
	282—287	4.7
	276—281	4.6
	270—275	4.5
	261—269	4.4
	252—260	4.3
	243—251	4.2
	234—242	4.1
2nd	225—233	4
	218—224	3.9
	211—217	3.8
	204—210	3.7
	197—203	3.6
	190—196	3.5
Unqual	0—189	0

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## APPENDIX D. VALIDATION OF AR+MK

Table 46 and Table 47 estimate “Success Score” Coefficients using AR+MK and AFQT, and interacting Hispanic with the respective test score. In the AR+MK model, the Hispanic interaction term is insignificant, indicating that there is not enough evidence to assert that the effect of AR+MK is different when comparing Hispanic and non-Hispanics. In the AFQT model, however, the Hispanic interaction term is statistically significant at the 5% level and negative, indicating that the effect of AFQT on Hispanic “Success Scores” is smaller than the effect of AFQT on non-Hispanic “Success Scores.” I repeat this analysis for the baseline Attrition, Reenlistment and Promotion models. The Hispanic interaction term is insignificant in all AR+MK models except for the E5 Promotion model, where it is significant at the 10% level of significance. The Hispanic interaction term is insignificant in the AFQT Reenlistment model and significant in the Attrition model at the 5% level of significance, the E5 Promotion model at the 1% level of significance and the E6 Promotion model at the 10% level of significance.

Table 53. “Success Score” Coefficients using AR+MK with Hispanic Interaction

Variable	OLS Coeff	Std. Err.	z
<b>Demographic Variables</b>			
female	-12.1366	1.1382	-10.66 ***
Hispanic entry	18.9547	8.7152	2.17 **
Black	11.2832	0.9589	11.77 ***
Asian	0.3192	1.6742	0.19
ALAN	-10.4468	2.6975	-3.87 ***
NHPI	11.5648	2.9400	3.93 ***
race declined	0.4773	0.8377	0.57
alien	17.8624	1.2671	14.10 ***
Married Entry	7.6776	1.5548	4.94 ***
# of dependents five YOS	2.3330	0.2626	8.88 ***
<b>Recruit Variables</b>			
Tier 2	-10.8249	1.7015	-6.36 ***
Tier 3	-27.2056	7.8707	-3.46 ***
AR+MK	1.1087	0.0232	47.75 ***
Hispanic AR+MK	-0.1150	0.0809	-1.42

Variable	OLS Coeff	Std. Err.	z
<b>Recruit Variables</b>			
Open Contract	-3.9602	1.0212	-3.88 ***
Advanced Pay Grade	10.6388	0.5368	19.82 ***
MCRD Parris Island	-11.6888	0.5020	-23.28 ***
Drug Waiver	-2.4588	0.5528	-4.45 ***
Law Waiver	6.3950	0.7062	9.06 ***
Unique Waiver	-0.1400	0.8862	-0.16
Medical Waiver	-13.8126	0.8324	-16.59 ***
Obese Contract Date	-68.4899	1.3028	-52.57 ***
Overweight Contract Date	-39.4589	0.5324	-74.11 ***
<b>Occupation Variables</b>			
OccFld 2	-7.2142	2.9336	-2.46 **
OccFld 3	-2.1977	1.3016	-1.69 *
OccFld 4	-16.3221	2.0843	-7.83 ***
OccFld 5	-19.1778	6.7655	-2.83 ***
OccFld 6	-32.8251	1.4354	-22.87 ***
OccFld 8	-25.2168	1.7962	-14.04 ***
OccFld 11	-3.0140	2.1621	-1.39
OccFld 13	-11.7757	1.5563	-7.57 ***
OccFld 18	-11.9842	2.0917	-5.73 ***
OccFld 21	-24.2874	1.8301	-13.27 ***
OccFld 23	-26.2702	2.8327	-9.27 ***
OccFld 26	-21.9163	2.1968	-9.98 ***
OccFld 28	-23.1015	2.0084	-11.50 ***
OccFld 30	-17.9246	1.6966	-10.56 ***
OccFld 31	-7.7162	4.0915	-1.89 *
OccFld 33	-58.2542	2.3770	-24.51 ***
OccFld 34	-0.9976	3.2282	-0.31
OccFld 35	-27.6068	1.4118	-19.55 ***
OccFld 43	-11.6194	4.4939	-2.59 **
OccFld 44	22.4582	4.9082	4.58 ***
OccFld 46	3.7759	5.1246	0.74
OccFld 55	-45.9577	3.2213	-14.27 ***
OccFld 57	-4.3022	3.3017	-1.30
OccFld 58	-6.5479	1.8937	-3.46 ***
OccFld 59	-8.3369	2.6631	-3.13 ***
OccFld 60	-17.1098	1.7766	-9.63 ***
OccFld 61	-23.6683	1.8743	-12.63 ***
OccFld 62	-26.5577	2.1018	-12.64 ***

Variable	OLS Coeff	Std. Err.	z
<b>Occupation Variables</b>			
OccFld 63	-13.1071	1.9772	-6.63 ***
OccFld 64	-22.8670	2.6301	-8.69 ***
OccFld 65	-6.9538	2.2296	-3.12 ***
OccFld 66	-15.2994	2.5816	-5.93 ***
OccFld 68	-44.5451	6.5707	-6.78 ***
OccFld 70	-5.0812	2.4003	-2.12 **
OccFld 72	-8.0929	2.4804	-3.26 ***
OccFld 73	-22.1110	6.0154	-3.68 ***
OccFld 99	9.2906	2.9114	3.19 ***
Cohort 2004	4.7949	0.9106	5.27 ***
Cohort 2005	2.1981	0.8978	2.45 **
Cohort 2006	3.9933	0.9017	4.43 ***
Cohort 2007	-1.7633	0.9287	-1.90 *
Cohort 2008	0.2150	0.9065	0.24
Cohort 2009	12.3053	0.9379	13.12 ***
Constant	1570.2100	2.9226	537.26 ***
*** - Indicates statistical significance at the 1% level			
** - Indicates statistical significance at the 5% level			
* - Indicates statistical significance at the 10% level			

Table 54. “Success Score” Coefficients using AFQT with Hispanic Interaction

Variable	OLS Coeff	Std. Err.	z
<b>Demographic Variables</b>			
female	-12.6009	1.1423	-11.03 ***
Hispanic entry	14.8785	2.9489	5.05 ***
Black	10.4827	0.9644	10.87 ***
Asian	4.2596	1.6724	2.55 **
ALAN	-9.5292	2.7013	-3.53 ***
NHPI	12.9484	2.9583	4.38 ***
race declined	0.6885	0.8414	0.82
alien	20.5992	1.2732	16.18 ***
Married Entry	6.2468	1.5612	4.00 ***
# of dependents five YOS	2.2922	0.2640	8.68 ***
<b>Recruit Variables</b>			
Tier 2	-13.0768	1.7083	-7.65 ***
Tier 3	-27.9507	7.9079	-3.53 ***
AFQT	0.5002	0.0147	33.97 ***
Hispanic AFQT	-0.1276	0.0510	-2.50 **

Variable	OLS Coeff	Std. Err.	z
<b>Recruit Variables</b>			
Open Contract	-5.2751	1.0242	-5.15 ***
Advanced Pay Grade	11.1956	0.5394	20.76 ***
MCRD Parris Island	-12.0148	0.5042	-23.83 ***
Drug Waiver	-2.5693	0.5540	-4.64 ***
Law Waiver	6.2739	0.7083	8.86 ***
Unique Waiver	-1.1911	0.8891	-1.34
Medical Waiver	-14.1054	0.8362	-16.87 ***
Obese Contract Date	-69.4416	1.3098	-53.02 ***
Overweight Contract Date	-39.8302	0.5345	-74.51 ***
<b>Occupation Variables</b>			
OccFld 2	-7.4634	2.9453	-2.53 **
OccFld 3	-3.7683	1.3071	-2.88 ***
OccFld 4	-16.9376	2.0929	-8.09 ***
OccFld 5	-16.8483	6.7868	-2.48 **
OccFld 6	-32.4852	1.4415	-22.54 ***
OccFld 8	-26.2653	1.8056	-14.55 ***
OccFld 11	-2.9434	2.1702	-1.36
OccFld 13	-12.1184	1.5635	-7.75 ***
OccFld 18	-13.6586	2.0995	-6.51 ***
OccFld 21	-24.7684	1.8385	-13.47 ***
OccFld 23	-26.8124	2.8459	-9.42 ***
OccFld 26	-18.6423	2.2133	-8.42 ***
OccFld 28	-20.1246	2.0238	-9.94 ***
OccFld 30	-17.9115	1.7028	-10.52 ***
OccFld 31	-9.8460	4.1192	-2.39 **
OccFld 33	-59.7910	2.3833	-25.09 ***
OccFld 34	0.8845	3.2549	0.27
OccFld 35	-28.8130	1.4181	-20.32 ***
OccFld 43	-11.5830	4.5138	-2.57 **
OccFld 44	22.4405	4.9289	4.55 ***
OccFld 46	2.4978	5.1440	0.49
OccFld 55	-44.2144	3.2405	-13.64 ***
OccFld 57	-3.0225	3.3069	-0.91
OccFld 58	-7.3183	1.8993	-3.85 ***
OccFld 59	-6.0741	2.6673	-2.28 **
OccFld 60	-16.4253	1.7879	-9.19 ***
OccFld 61	-23.1929	1.8808	-12.33 ***
OccFld 62	-25.7987	2.1099	-12.23 ***

Variable	OLS Coeff	Std. Err.	z
<b>Occupation Variables</b>			
OccFld 63	-11.0974	1.9880	-5.58 ***
OccFld 64	-20.1290	2.6368	-7.63 ***
OccFld 65	-6.6724	2.2431	-2.97 ***
OccFld 66	-14.0706	2.5896	-5.43 ***
OccFld 68	-43.5901	6.6151	-6.59 ***
OccFld 70	-5.0532	2.4090	-2.10 **
OccFld 72	-7.9663	2.4921	-3.20 ***
OccFld 73	-19.2608	6.0739	-3.17 ***
OccFld 99	10.5175	2.9228	3.60 ***
Cohort 2004	5.2052	0.9128	5.70 ***
Cohort 2005	2.0914	0.9010	2.32 **
Cohort 2006	3.6626	0.9051	4.05 ***
Cohort 2007	-2.4872	0.9321	-2.67 ***
Cohort 2008	-0.4943	0.9105	-0.54
Cohort 2009	11.4324	0.9418	12.14 ***
Constant	1661.0290	1.7103	971.22 ***
*** - Indicates statistical significance at the 1% level			
** - Indicates statistical significance at the 5% level			
* - Indicates statistical significance at the 10% level			

I exported the data set into JMP Pro 10 and divided the data into a test group (20% of the total sample) and a control group (80% of the total sample). I estimated Any Attrition using the baseline attrition model explained in Chapter V for only the control group. Using the estimates from the model, I predicted attrition for the test group and compared the predictive capability of the AR+MK and the AFQT models (Table 48). The misclassification rate was 24.1% for AR+MK and 23.9% for AFQT. Misclassification of actual stayers as predicted attritors was more likely in the AR+MK model and misclassification of actual attritors as predicted stayers was more likely in the AFQT model.

Table 55. Predictive Capability AR+MK versus AFQT

ARMK		
	Attrite	Stay
Predict Attrite	3.61%	11.47%
Predict Stay	12.63%	72.29%
AFQT		
	Attrite	Stay
Predict Attrite	3.50%	11.17%
Predict Stay	12.74%	72.59%

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